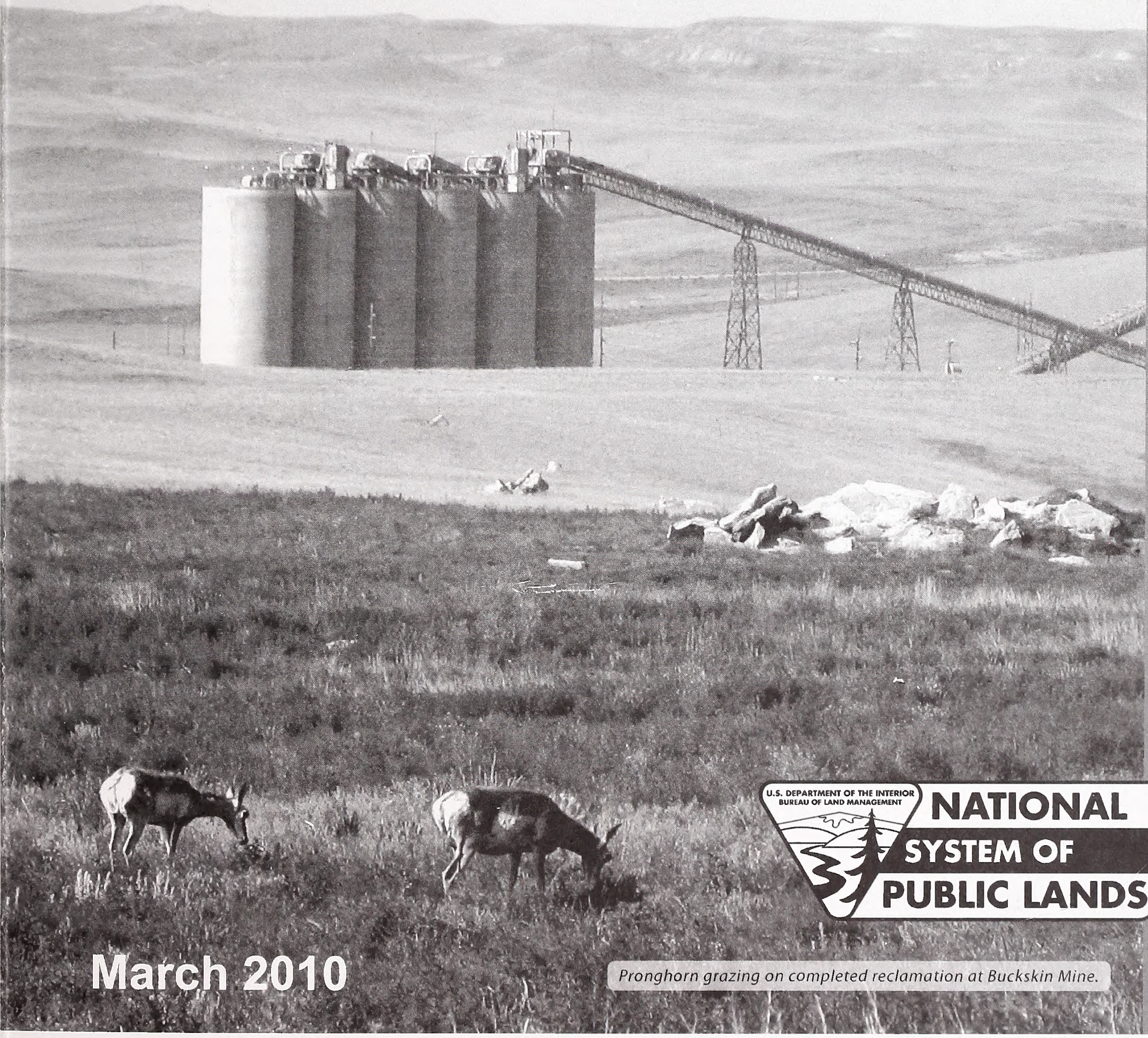
BLM

DRAFT
Environmental Impact Statement for the Buckskin Mine Hay Creek II Coal Lease Application WYW-172684



Wyoming High Plains District

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
NATIONAL SYSTEM OF PUBLIC LANDS

March 2010

Pronghorn grazing on completed reclamation at Buckskin Mine.

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-10/001+1320

Cover photo: Buckskin Mine 2007.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
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Cheyenne, Wyoming 82003-1828

TAKE PRIDE® IN AMERICA

In Reply Refer To:
3425 (LBA)
WY922 (Sackett)
WYW 172684
Hay Creek II Coal EIS

MAR 0 3 2010

Dear Reader:

The Bureau of Land Management (BLM) has prepared this draft environmental impact statement (DEIS) to document and disclose the results of an environmental analysis for one application received by BLM to lease a tract of Federal coal. The tract is located in the Wyoming Powder River Basin at the Buckskin Mine in Campbell County. A copy of this document is provided for your review and comments. The DEIS may also be reviewed at the following website:

http://www.blm.gov/wy/st/en/info/NEPA/cfodocs/HayCreekII.html

Copies of the DEIS are also available for public inspection at the following BLM offices:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, WY 82009

Bureau of Land Management
Wyoming High Plains District Office
2987 Prospector Drive
Casper, Wyoming 82604

A formal public hearing on this application to lease Federal coal will be held at 7 p.m. on April 22, 2010, at the George Amos Memorial Building, 412 South Gillette Avenue, Gillette, Wyoming. The purpose of the hearing is to receive comments on the proposed coal lease sales, on the fair market value, and on the maximum economic recovery of the Federal coal resources included in the tracts.

The BLM will accept public comments on this DEIS, for sixty (60) days commencing on the date the Environmental Protection Agency publishes its Notice of Availability in the *Federal Register*. Comments received after the end of the 60-day comment period will be considered in preparation of the final environmental impact statement (EIS) as time permits. The BLM is also publishing a Notice of Availability and Notice of Hearing in the *Federal Register*.

If you wish to comment on the DEIS, your comments should relate directly to the document. Comments should be as specific as possible. The sections and page numbers of the DEIS that you are commenting on should be cited. The agencies involved in preparing this draft EIS are required to respond in the final EIS to all substantive comments submitted. Substantive comments should: (1) give any new information that could alter conclusions; (2) show why or

how analysis or assumptions in the DEIS are flawed; (3) show errors in data, sources, or methods; or, (4) request clarifications that bear on conclusions. Opinions or preferences will not receive a formal response, but they will be considered and included as part of the BLM decision-making process.

This DEIS was prepared pursuant to the National Environmental Policy Act and applicable regulations, and other applicable statutes, to address possible environmental and socioeconomic impacts that could result from this project. This DEIS is not a decision document. Its purpose is to inform the public and the agency decision-makers of the impacts of leasing some or all of the Federal coal in the Hay Creek II study area to the existing applicant mine in the Wyoming Powder River Basin and to evaluate alternatives to leasing the Federal coal included in the tract as applied for.

Comments, including names and addresses of respondents, will be available for public review at the address listed below during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays, and will be published as part of the final EIS. Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Please send written comments to Bureau of Land Management, High Plains District Office, Attn: Teresa Johnson, 2987 Prospector Drive, Casper, WY 82604. Written comments may also be e-mailed to the attention of Teresa Johnson at "Hay_Creek_II_WYMail@blm.gov". E-mail comments must include the name and mailing address of the commentor to receive consideration. Written comments may also be faxed to (307) 261-7587.

If you have any questions or would like to obtain an additional copy of this DEIS in either hard copy or PDF, please contact Teresa Johnson at (307) 261-7510, or at the above address

Sincerely,

Larry Claypool

for Donald A. Simpson
State Director

EXECUTIVE SUMMARY

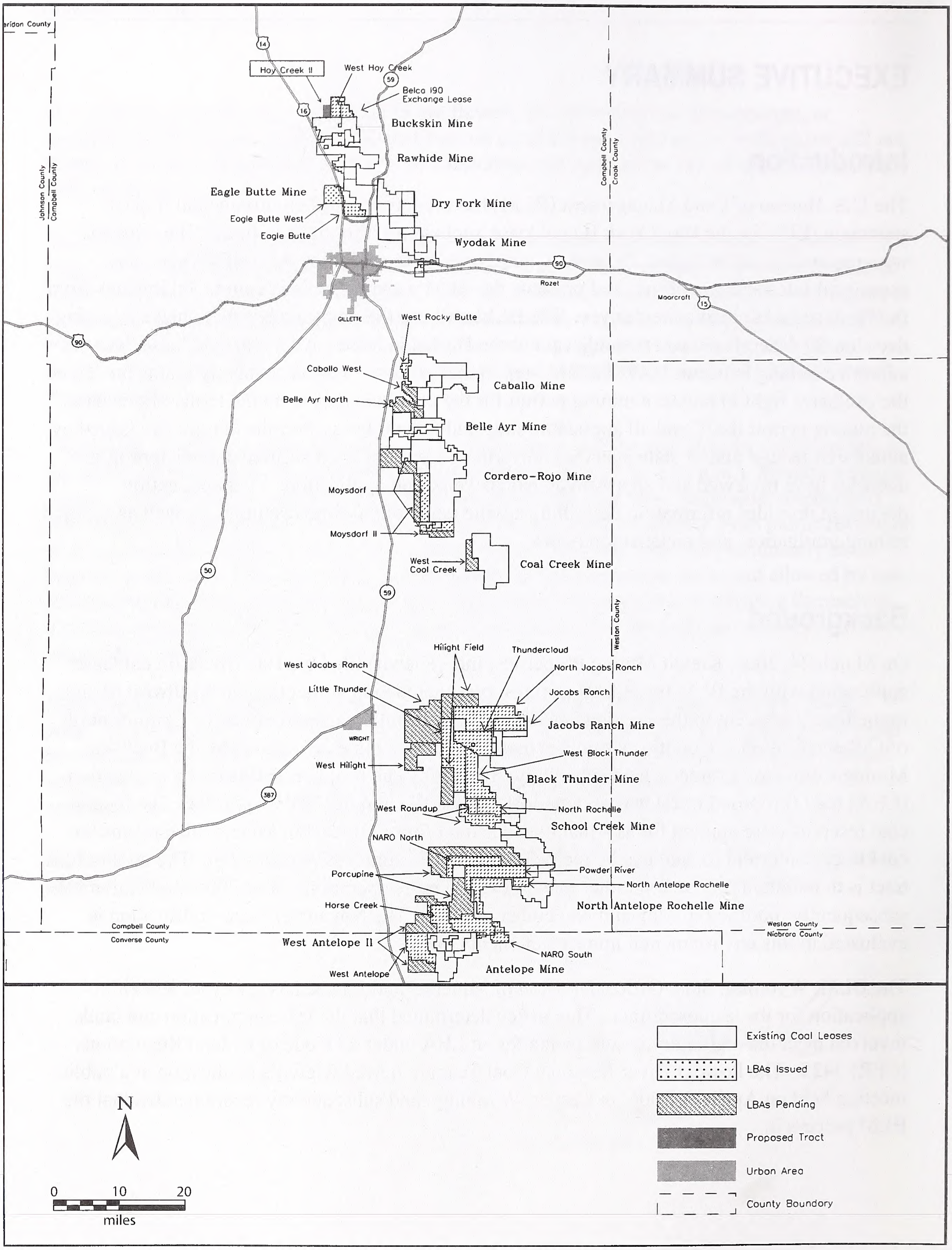
Introduction

The U.S. Bureau of Land Management (BLM) has prepared a draft environmental impact statement (EIS) for the Hay Creek II coal lease application (Proposed Action). The draft EIS was prepared in accordance with the National Environmental Policy Act (NEPA) and its associated rules and guidelines, and presents the BLM's analysis of environmental impacts from the Proposed Action and alternatives. The BLM will use this impact analysis to make a leasing decision for federal coal reserves adjacent to the Buckskin Mine. A federal coal lease does not authorize mining to occur, but is the first step in that process. The lease merely grants the lessee the exclusive right to pursue a mining permit for the coal tract subject to the terms of the lease, the mining permit itself, and all applicable state and federal laws. Permits to mine are issued by authorized federal and/or state agencies only after a lease has been secured and all appropriate agencies have reviewed and approved an extensive permit application. That application document provides information describing a wide range of baseline resources, as well as detailed mining, mitigation, and reclamation plans.

Background

On March 24, 2006, Kiewit Mining Properties, Inc. (Kiewit) filed the Hay Creek II coal lease application with the BLM for federal coal reserves included in a tract located northwest of and immediately adjacent to the existing Buckskin Mine permit area, approximately 12 miles north of Gillette, Campbell County, Wyoming (map ES-1). The mine is operated by the Buckskin Mining Company, a directly held subsidiary of Kiewit. The Hay Creek II lease by application (LBA) tract (proposed tract) was assigned BLM case file number WYW-172684. The federal coal reserves were applied for as a maintenance tract for the Buckskin Mine, which means the coal tract is adjacent to, and can be recovered by, the existing active coal mine. The intent of the tract is to maintain production rather than to expand mine operations. The 2006 application was subsequently modified in May and November of 2008. The November tract modification is evaluated in this environmental impact statement (EIS).

The BLM, Wyoming State Office, Division of Minerals and Lands, has reviewed Kiewit's application for the proposed tract. That office determined that the lease application and lands involved meet the regulatory requirements for an LBA under 43 Code of Federal Regulations (CFR) 3425. The Powder River Regional Coal Team reviewed Kiewit's application at a public meeting held on April 19, 2006, in Casper, Wyoming, and subsequently recommended that the BLM process it.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-1

General Location Map with Federal Coal Leases and LBA Tracts

Evaluation and Environmental Review Process

To process an LBA, the BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal. The BLM also must fulfill the requirements of NEPA by evaluating the environmental impacts of leasing that coal. NEPA requires the BLM to consider and evaluate reasonable alternatives to the Proposed Action, including a "no action" alternative. This EIS has been prepared to evaluate the site-specific and cumulative environmental impacts of leasing and recovering the federal coal reserves in the proposed tract or an alternative tract configuration, as determined by the BLM. In keeping with the purpose of an EIS, the analyses presented in this document are based primarily on existing information.

The BLM leasing process does not authorize mining of federal coal reserves; applicants must obtain permits from appropriate federal and/or state agencies to mine the coal. However, because mining is a logical consequence of issuing a maintenance lease to an existing operation, the impacts of mining the coal are considered in this EIS.

The BLM will use the analyses in this EIS to decide whether to hold a competitive sale and issue a lease for the federal coal reserves in the proposed tract or an alternative tract configuration. The LBA process by law and regulation is an open, public, competitive sealed-bid process. If a sale is held for a tract, the bidding would be open to any qualified bidder; it would not be limited to the applicant. A coal lease is issued to the highest bidder at the sale, if a federal sale panel determines that the high bid meets or exceeds the fair market value of the coal as determined by the BLM's economic evaluation, and if the U.S. Department of Justice determines that no antitrust violations would result from assigning the lease to the high bidder. A decision to lease these federal coal reserves would be in conformance with the BLM resource management plan for the Buffalo and Casper field offices.

Regardless of whether the successful bidder is the applicant or a new operator, the lessee would be required to submit a permit application, including detailed mining, monitoring, mitigation, and reclamation plans to the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) for review. The operator would also be required to submit a Resource Recovery and Protection Plan to the BLM for review. Before mining operations could begin in the new tract, the mining permit must be approved by WDEQ/LQD, the Resource Recovery and Protection Plan must be approved by the BLM, and a Mineral Leasing Act mining plan must be approved by the Assistant Secretary of the Interior.

Other agencies will also use this EIS analysis to make decisions related to leasing and mining the federal coal in the proposed tract or an alternative tract configuration. Cooperating agencies in the preparation of this draft EIS include the Office of Surface Mining Reclamation and Enforcement, all divisions of the Wyoming Department of Environmental Quality (WDEQ), the Wyoming Game and Fish Department (WGFD), and the Wyoming Department of Transportation.

The U.S. Environmental Protection Agency (EPA) will publish a Notice of Availability for the draft EIS in the *Federal Register*. A 60-day comment period on the document will commence with that published notice. The BLM will also publish a Notice of Availability along with a Notice of Public Hearing in the *Federal Register*. The hearing notice will announce the date and time of a public hearing to be held during the 60-day comment period. The purpose of the hearing will be to solicit public comments on the draft EIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of federal coal reserves considered for mining in this EIS. The BLM will also publish a notice of public hearing in the Gillette *News-Record* and other local newspapers. All substantive comments received on the draft EIS will be included, with agency responses, in the final EIS.

Purpose and Need

The purpose of the Proposed Action is to provide a technically and economically feasible method for the Buckskin Mine to pass through a geologic irregularity, known as the Sand Channel Area, to reach low-sulfur compliance coal in the existing Spring Draw lease (WYW-78634). The Proposed Action would not expand operations at the Buckskin Mine, but would extend the life of the mine by approximately two years[1].

More broadly, the Proposed Action responds to the continued demand for coal in the U.S., primarily for the purpose of generating electricity. According to the Energy Information Administration (2008a), the U.S. has the world's largest known coal reserves. Demand for this coal is driven by the electric power sector, which accounts for about 92% of coal consumption (Energy Information Administration 2008a, 2008b). Approximately half of the electricity currently generated in the U.S. comes from coal (U.S. Department of Energy 2009). Wyoming coal is used to generate electricity in 37 other states (Wyoming Mining Association 2009).

The BLM recognizes that the continued extraction of coal is essential to meet the nation's future energy needs and goals. Consequently, private development of federal coal reserves is integral to the BLM's coal leasing program under the authority of the Mineral Leasing Act of 1920, as well as the Federal Land Policy Management Act (FLPMA) and the Federal Coal Leasing Amendments Act of 1976. Under FLPMA, the BLM is mandated to manage public lands for multiple-use so that the lands are utilized in the combination that will best meet the present and future needs of the American people.

Management of federal coal resources—leasing, mining, and selling—in the PRB contributes to a reliable supply of low-sulfur compliance coal for electric power generation in the U.S. This domestic supply enables coal-fired power plants to meet current Clean Air Act requirements and increasing demand without potentially significant increases in power costs while new technologies are developed to improve efficiency and reduce emissions. Management of federal

[1] Assuming that coal production would continue at the most recent (2008) annual coal production rate of 25 million tons per year.

coal resources in the PRB also generates revenue—in the form of bonus, annual rental, and royalty payments—that is used to fund numerous infrastructure and social projects in Wyoming.

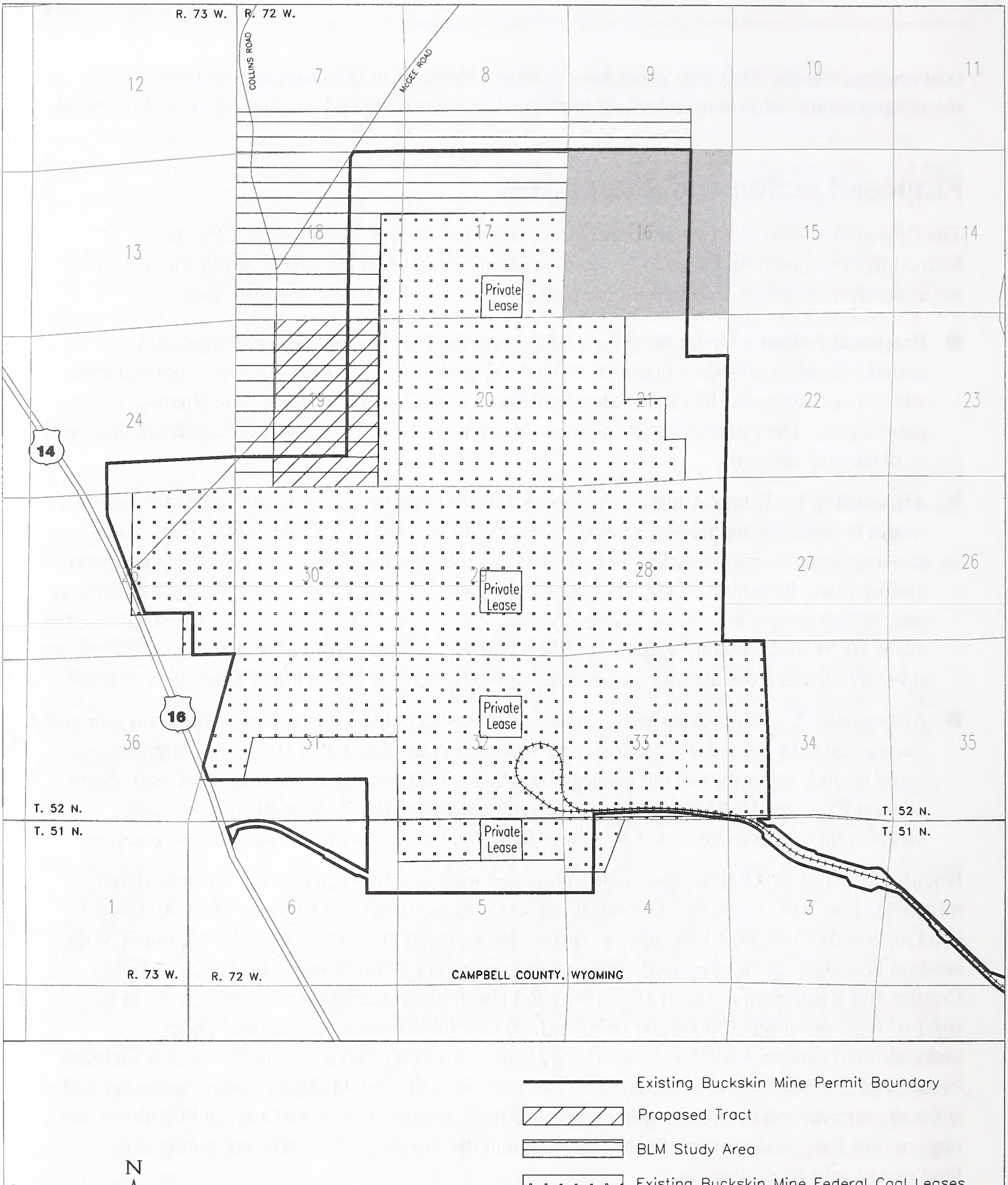
Proposed Action and Alternatives

The Proposed Action and two alternatives are analyzed in detail in this draft EIS; their boundaries are shown on map ES-2. No new life-of-mine facilities would be built under any of the alternatives; coal reserves would be mined as an extension of the existing mine.

- **Proposed Action** – Under the Proposed Action, the BLM would hold a competitive, sealed-bid sale and issue a lease for the federal coal reserves included in the proposed tract, which is a contiguous block of federal coal reserves adjacent to the existing Buckskin Mine permit area. The proposed tract includes approximately 419 acres and 77.2 million tons of in-place coal reserves.
- **Alternative 1** – Under Alternative 1, the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be offered for sale at this time. The existing leases at the Buckskin Mine would be developed according to the current approved mining plan. Rejection of the lease application would not preclude an application to lease a tract in that area in the future. Approximately 182 acres of the proposed tract and 436.5 acres of the BLM study area overlap the existing Buckskin Mine permit area, and are, therefore, subject to surface disturbance associated with existing coal leases under existing conditions.
- **Alternative 2** – Under Alternative 2, the BLM would hold a competitive, sealed-bid sale and issue a lease for the federal coal reserves included in an alternative tract configuration that could include all or part of the proposed tract and additional reserves within the area shown on map ES-2, the BLM study area, as determined by the BLM. The BLM study area includes up to approximately 1,883 acres and 269.7 million tons of in-place coal reserves.

Not all of the federal coal reserves in the proposed tract and BLM study area are considered mineable at present. Campbell County Road 23 (Collins Road) and Campbell County Road 73 (McGee Road) cross the BLM study area from its southern to northern boundaries; much of the western boundary of the proposed tract is adjacent to the Collins Road. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) prohibits mining under a public road, in its right-of-way, or within 100 feet on either side of the right-of-way, as specified under unsuitability criterion 3 (43 CFR 3461.5[c][2][iii]). An exception to this prohibition is included in the SMCRA regulations at section 522(e)(4) and 30 CFR 761.11(d)(2), which can be applied if the appropriate road authority allows the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected.

Under the same unsuitability criterion, the land underlying an occupied residence in the BLM study area is also considered unsuitable for mining. Surface disturbance at the residence and a 300-foot buffer around it would be prohibited unless Kiewit were to purchase the surface rights associated with the home and its buffer zone.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-2
Proposed Tract and BLM Study Area

Kiewit does not currently plan to pursue efforts to close or relocate either county road, or acquire the surface rights to the land associated with the occupied residence; therefore, the company considers the lands around those features inaccessible and operationally limited. Nevertheless, the coal underlying these structures and their buffers is still considered for leasing because those reserves could be mined if the authorized agency determines that one or both roads can be closed or moved, or if Kiewit acquires the surface rights to the occupied residence. Including the coal underlying those features in the lease would also allow for maximum recovery of all the mineable coal adjacent to, but outside of, their respective buffer zones, even if no action is taken to seek an exception to unsuitability criterion 3. If a lease is issued for a tract, a stipulation will be attached stating that no mining activity may be conducted in the portion of the lease underlying the county roads, their rights-of-way, and buffer zones and occupied residence and buffer zone unless approval is obtained from the appropriate authority to move or close the roads or acquire surface rights associated with the occupied residence, respectively.

The BLM study area and immediate vicinity include small areas of agricultural lands (crops, hayfields, and pastures), several overhead electric power lines, oil and gas pipelines, and two unoccupied residences. Before any surface disturbance or other mine-related activities could begin, support infrastructure such as power lines, gas pipelines, and flood- and sediment-control features would be built or relocated, as needed.

The analyses presented in this draft EIS assume that Kiewit would be the successful bidder under both the Proposed Action and Alternative 2 (action alternatives). Kiewit would add the tract as an integral extension of existing operations at the Buckskin Mine. Facilities and infrastructure would be the same as those currently identified in the WDEQ/Land Quality Division (LQD) Mine Permit 500 Term T7, approved May 22, 2006, and the *BLM Resource Recovery and Protection Plan*, approved June 16, 2006. Kiewit would submit an application to the WDEQ/LQD to amend its existing surface mining permit and mining plan to incorporate the final tract configuration; that application would include detailed amendments to the current monitoring and mitigation plans to include a new lease area.

Table ES-1 describes projected coal production, surface disturbance, mine life, and projected federal and state revenues for the Buckskin Mine under each of the alternatives analyzed in this EIS. These figures are based on the current and projected average coal production rate of 25 million tons per year, and the assumption that coal reserves under the public roads and occupied residence would not be mined.

Table ES-1. Comparison of Additional Coal Production, Surface Disturbance, Mine Life, and Revenues under the Proposed Action and Alternatives

Item	Existing Buckskin Mine Permit Area	Additional Under: Alternative 1 (No Action)	Additional Under: Proposed Action[1,3]	Additional Under: Alternative 2[2,3]
In-Place Coal (as of 12-31-08)	460.9 mmt	0	77.2 mmt	269.7 mmt
Mineable Coal (as of 12-31-08)[4]	361.9 mmt	0	60.1 mmt	166.3 mmt
Recoverable Coal (as of 12-31-08)[4,5]	344.3 mmt	0	54.1 mmt	149.7 mmt
Potential Lease Area	6,438.2 acres	0	419.04 acres	1,883.1 acres
Total Disturbance Area[6]	6,727.8 acres[7]	0	478 acres	618 acres
Permit Area[8]	8,011.5 acres	0	1,009 acres	2,191.6 acres
Average Annual Post-2008 Coal Production	25 mmt	0	0	0
Remaining Life of Mine (Post-2008)[9]	14 years	0	2 years	6 years
Average Number of Employees	338	0	0	0
Total Projected State and Local Revenues (Post-2008)[10,11]	\$563.6 million	0	\$90.6–\$108.8 million	\$250.2–\$300.4 million
Total Projected Federal Revenues (Post-2008)[12]	\$417.0 million	0	\$69.2–\$87.3 million	\$191.0–\$241.1 million

mmt = million tons

1 Numbers are based on the entire proposed tract, which includes a 182-acre overlap with the existing Buckskin Mine permit area; that overlap was not factored into calculations for coal reserves for the existing mine, but was included in total disturbance numbers for the existing mine.

2 Numbers were calculated based on the entire BLM study area, which includes a 436.5-acre overlap with the existing Buckskin Mine permit area; that overlap was not factored into calculations for coal reserves for the existing mine, but was included in total disturbance numbers for the existing mine.

3 Coal numbers assume mining of the entire proposed tract or BLM study area. Estimates for total disturbance include additional lands in a buffer outside of those areas within the general analysis area, excluding operationally limited lands west of both county roads and around the occupied residence.

4 Mineable and recoverable coal figures under the Proposed Action and Alternative 1 are maximum estimates and do not account for coal reserves that would not be mined beneath the occupied residence and associated 300-foot buffer zone, or the public road rights-of-way (Collins and McGee roads), their associated 100-foot buffer zones, and other operationally limited lands between the two roads.

5 Recoverable coal figures assume a recovery rate of 95% for coal in the Canyon seam and a 90% for all other coal reserves; they do not include coal left behind as support pillars and similar structures, or unavoidably lost through spillage and spontaneous natural fires during normal mining operations.

6 The total area to be disturbed exceeds the leased area under the existing Buckskin Mine and the Proposed Action because of the need for highwall reduction, topsoil removal, and other mine support activities that cause surface disturbance outside the lease boundaries. The permit area is larger than the leased or disturbed area to ensure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description. The total area to be disturbed does not include lands under public roads, in their rights-of-way or 100-foot buffer zones, in the 300-foot buffer zone around the occupied residence, or in the operationally limited lands west of the Collins and McGee roads; those expected exclusions result in a smaller disturbance area than lease area under Alternative 2.

7 Includes federal and state coal leases currently held by the Buckskin Mining Company.

8 Pending WDEQ permit revision under the Proposed Action and Alternative 2.

9 Assumes average current average annual coal production rate of 25 million tons continues through life-of-mine.

10 Revenues to the State of Wyoming and local governments include severance taxes; property and production taxes (ad valorem); sales and use taxes; and Wyoming's share of federal royalty payments, bonus bids, annual rental payments, and Abandoned Mine Land fees. State revenues are based on an assumed price of \$7.85 per ton of "recoverable coal," federal royalty of 12.5% of the value less 51% federal share, plus \$0.315 per ton for Abandoned Mine Land fees on assumed 25% state share, plus bonus payments of between \$0.30 and \$0.97 per ton of LBA leased coal per ton (based on average of six LBAs in 2004 and 2005) times the tonnage of recoverable coal times a 50% state share, plus \$0.07 per ton estimated sales and use taxes, plus \$0.33 per ton estimate for ad valorem taxes, plus \$0.415 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered (i.e., taxes generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included. These figures could change based on the outcome of recent legislation that changed the percentage of distribution to states.

11 Revenues for Alternative 1 do not include the \$4.2 million in scheduled coal lease bonus bids to be paid on the final tract configuration in fiscal year 2009.

12 Federal revenues are based on an assumed price of \$7.85 per ton, federal royalty of 12.5% times 51% share, plus \$0.315 per ton for Abandoned Mine Land fees times an assumed 75% federal share, plus black lung tax of \$0.00261 per ton, plus bonus payments of between \$0.30 and \$0.97 per ton of LBA leased coal (based on the range of the six LBA sales in 2004 and 2005) times tonnage of recoverable coal minus a 50% federal share. These figures could change based on the outcome of recent legislation that changed the percentage of distribution to states.

Other alternatives that were considered but eliminated from further analysis in this EIS include:

- **Alternative 3** – Under Alternative 3, the BLM would hold a competitive, sealed-bid sale and issue a lease for a coal tract to a successful bidder other than the applicant for the purpose of developing a new stand-alone mine.
- **Alternative 4** – Under Alternative 4, the BLM would delay the sale of a new coal tract with the goal of increasing the public benefit should higher coal prices be in place at a later date and/or to allow more complete recovery of the potential coal bed natural gas (CBNG) resource prior to mining.

The current economies of mining in the Powder River Federal Coal Region appear to make construction of a new mine economically unfeasible using estimated in-place coal reserves in the proposed tract or alternative tract configuration. The BLM currently estimates that a tract would need to include as much as 500 to 600 million tons of in-place coal to attract a buyer interested in opening a new mine in the Wyoming PRB. Neither the proposed tract (approximately 77 million tons) nor the BLM study area (about 270 million tons) includes sufficient in-place coal resources to justify the costs of opening a new mine. Given these limitations and other assumptions associated with a new mine start, such as the necessary annual production and competition for market share, Alternative 3 is not analyzed further in this EIS. Alternative 4 was not analyzed in detail because it would not produce substantially different impacts from the alternatives analyzed in this EIS; only the timing and possibly the economic return of the sale would differ.

Resources Addressed in this Environmental Impact Statement

The BLM requires that certain elements are analyzed when present in the affected environment. Map ES-3 shows the general analysis area for most resources analyzed in this EIS. This area encompasses the BLM study area (including the proposed tract) and a 0.25-mile-wide buffer to the north and west for a total of approximately 2,847 acres.

Required elements present in the general analysis area and addressed in this EIS include:

- air quality (section 3.4);
- water quality (section 3.5);
- wetlands/riparian zones (section 3.7);
- invasive non-native species (section 3.9);
- threatened and endangered species (sections 3.9 and 3.10);
- cultural resources (section 3.12);
- hazardous or solid wastes (section 3.16);
- Native American religious concerns (section 3.17); and
- environmental justice (section 3.17).

The following additional resources also are present in the general analysis area and are addressed in this EIS:

- topography and physiography (section 3.2);
- geology, mineral, and paleontological resources (section 3.3);
- other water resources (section 3.5);
- alluvial valley floors (section 3.6);
- soils (section 3.8);
- vegetation (section 3.9);
- wildlife (section 3.10);
- land use and recreation (section 3.11);
- visual resources (section 3.13);
- noise (section 3.14);
- transportation resources (section 3.15); and
- socioeconomics (section 3.17).

Five additional aspects considered in this chapter are:

- regulatory compliance;
- mitigation and monitoring;
- residual impacts;
- the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity (3.18); and
- any irreversible and irretrievable commitments of resources that would be associated with the action alternatives (42 United States Code § 4332[C]) (3.19).

The following elements, which are required by the BLM when present in the affected environment, are not present in the general analysis area and are not addressed in this EIS:

- areas of critical environmental concern;
- prime or unique farmlands;
- floodplains;
- wild and scenic rivers; and
- wilderness.

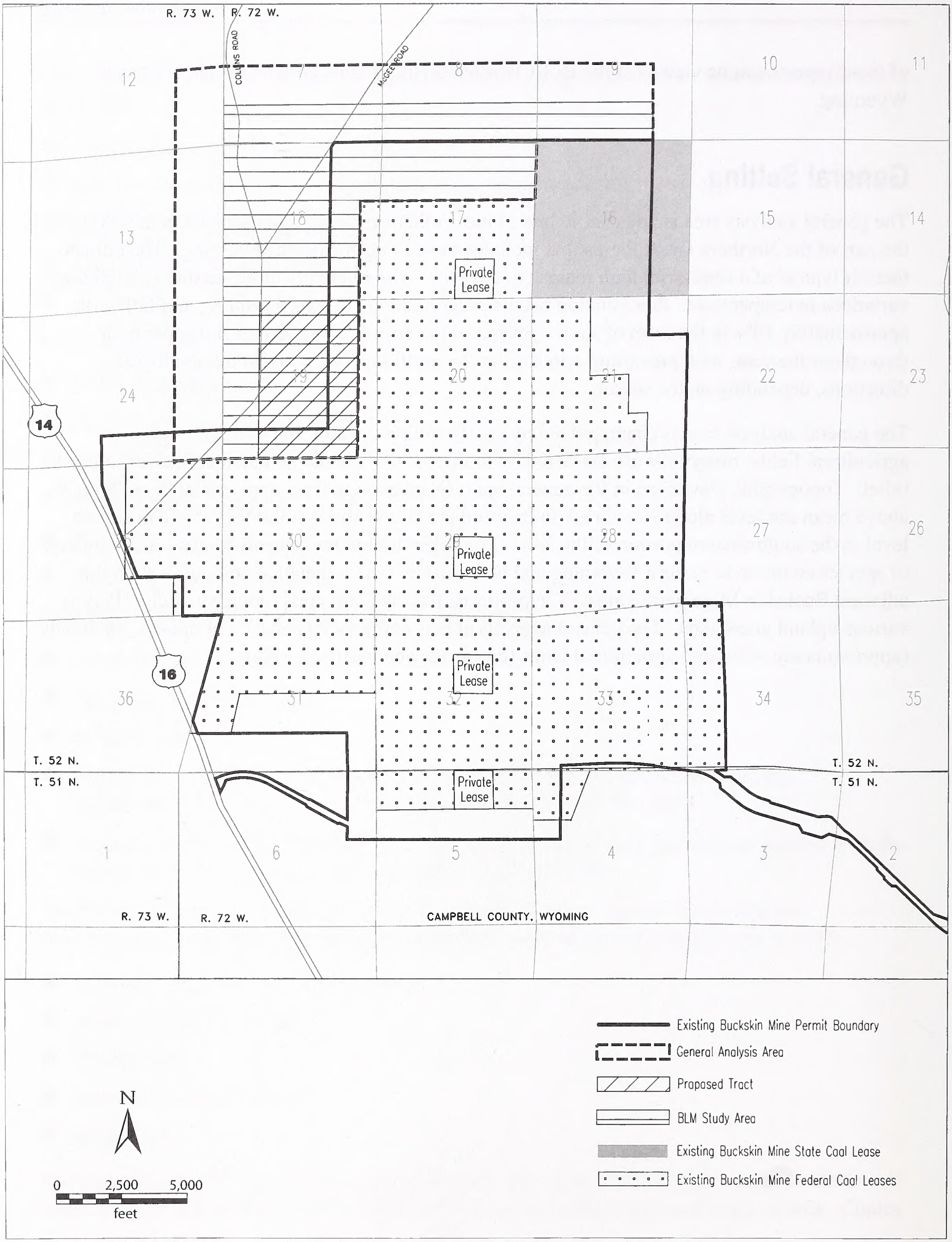
Individual data reports have been prepared for most resources to provide additional detailed information on the affected environment for the proposed tract and general analysis area. Copies

of those reports can be viewed at the BLM Wyoming High Plains District Office in Casper, Wyoming.

General Setting

The general analysis area is adjacent to one of the northern-most operating mines in the PRB, in the part of the Northern Great Plains that includes most of northeastern Wyoming. The climate there is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature. Precipitation occurs predominantly during the spring and fall, with approximately 10% in the form of snow. Surface wind speeds average 10.5 miles per hour throughout the year, with prevailing winds from the north-northwest and south-southeast directions, depending on the season.

The general analysis area is characterized by gently rolling uplands and relatively level agricultural fields; many hills are dissected by drainages that create moderate variations in local relief. Topographic elevations in the general analysis area range from approximately 4,080 feet above mean sea level along Hay Creek in the northern tier to about 4,380 feet above mean sea level in the southwestern portion of the area. The vegetation in the general analysis area consists of species common to eastern Wyoming and is consistent with vegetative communities in the adjacent Buckskin Mine permit area. The proposed tract is dominated (approximately 71%) by various upland grasslands. The general analysis area is comprised primarily of upland grasslands (approximately 40%) and agricultural lands (croplands and pastures, 31%).



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-3
General Analysis Area

Summary of Impacts

The general analysis area represents the maximum surface area that could be disturbed by mining activities analyzed in this EIS. Surface disturbance occurs outside of a coal lease area as a result of activities including, but not limited to, overstripping, highwall back-sloping (including catch benches), highwall reduction after mining to match undisturbed topography, and construction of flood- and sediment-control structures.

Alternative 1 (No Action Alternative)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. However, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future. Under the No Action Alternative, impacts in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would consist of temporary surface disturbance from activities necessary to support mining (described above) on existing leases.

Proposed Action and Alternative 2

This section focuses on the expected impacts of the two action alternatives analyzed in this EIS. Background information and details supporting the determinations for individual resources are provided in chapter 3.

Topography

Under both action alternatives, surface coal mining would permanently alter the topography of the proposed tract or BLM study area through blasting, hauling, and stockpiling of overburden and interburden. Postmining topography would be recontoured under either scenario to resemble the premining topography and the basic drainage system would be retained, but the reclaimed lands would be approximately 60 feet lower and somewhat gentler and more uniform in appearance.

These changes in the landscape would result in minor to moderate, long-term reductions in microhabitats and habitat diversity in the affected area. As discussed under the Wildlife Resources heading below, affects on wildlife would be minor to moderate, depending on the species, and short-term. Long-term beneficial impacts of the lower and flatter terrain would be reduced water runoff, which would increase infiltration rates for precipitation and reduce erosion, and may also increase vegetative productivity and potentially accelerate recharge of groundwater. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support the anticipated future land use of the mined area.

Geology and Coal Resources

The Paleocene Fort Union Formation is the stratigraphic unit (i.e., geological layer) which contains the coal seams that would be mined under the action alternatives. This formation is divided into the Tongue River, Lebo, and Tullock members. The Anderson and Canyon coal seams of the Tongue River Member are targeted for mining in the BLM study area (the maximum extent of leasable coal in the general analysis area).

Under both action alternatives, removal of overburden, interburden, and coal reserves would have a moderate but permanent impact on the geology and coal resources on up to 1,883 acres in the BLM study area, with the area of impact depending on the final tract configuration. An average of about 250 feet of overburden and interburden, 30 feet of Anderson coal, and 70 feet of Canyon coal would be removed under either action alternative. Approximately 54 million tons of coal would be recovered from the proposed tract, and up to 149.7 million tons from the BLM study area.

Overburden removed during mining would be replaced with a relatively homogenous mixture of partially compacted rock and soil that would be significantly altered from the original distinct layers. Mining support and reclamation activities would cause temporary surface disturbance on an additional buffer in the general analysis area outside of the final tract configuration.

Other Minerals

The Anderson and Canyon coal seams tapped for CBNG development are the same seams that are being mined at the Buckskin Mine. Wyoming Oil and Gas Conservation Commission records indicate that as of May 2008, 30 CBNG wells have been completed in the general analysis area. Half of those wells are producing and the rest have been shut in, are no longer producing, have been permanently abandoned, or have expired permits. Commission records indicate that no CBNG wells have been completed below the Anderson and Canyon seams within the general analysis area. No conventional oil and gas wells are located in the general analysis area. Additionally, no bentonite or uranium reserves have been identified in the general analysis area. Scoria breaks are absent from the proposed tract, but do occur on some hillsides along the northern edge of the general analysis area.

Under the action alternatives, development of other minerals present in the general analysis area could not occur during mining, but could resume after mining. Surface coal mining would have permanent impacts on oil and gas (conventional and CBNG) resources located in and above the mined coal seams. Resources that are not recovered prior to mining would be irretrievably lost when the coal is removed. Dewatering wells and active mining would combine with ongoing CBNG production to deplete the hydrostatic pressures and methane resources adjacent to mining areas a short time after mining would begin.

The action alternatives would have no impact on bentonite or uranium resources because they are not present in the general analysis area. Mining would remove or reduce the scoria hills along the northern portion of the general analysis area, resulting in a permanent loss of those resources and a change in topographic relief.

Paleontological Resources

Two formations exposed on the surface of the general analysis area could contain paleontological resources: the Paleocene Fort Union Formation and the Paleocene and Eocene Wasatch Formation (Breckenridge 1974; Love and Christiansen 1985). Both of these sedimentary formations are known to yield vertebrate fossils in Wyoming (Estes 1975; Roehler 1991; Secord 1998; Robinson et al. 2004).

No significant or unique paleontological resources have been reported by the Buckskin Mine and none were recorded on the surface in the general analysis area during surveys conducted for the draft EIS. No specific mitigation was recommended for the action alternatives and no further paleontological work was recommended or required. Additional surveys for paleontological resources may be required if discoveries are made during mining operations. Undiscovered resources not exposed on the surface or detected during mining would be permanently lost.

Air Quality

Particulate and gaseous emissions are the two primary types of air pollutants directly associated with surface coal mining in the PRB; both are associated with a variety of health and environmental impacts. In general, PM_{10} particulate matter is the major significant pollutant from coal mine point (stationary) and fugitive (non-point) sources; PM_{10} is coarse particulate with mean aerodynamic diameters less than 10 microns. The major sources of particulate emissions (solid particles and liquid droplets that can be suspended in air) at surface coal mines are fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed land all produce fugitive dust. The most common point sources of particulate matter are associated with coal crushing, storage, and handling facilities.

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_x. These are the primary fugitive gaseous emissions produced during surface coal mining operations. Nitrogen oxides are generated from tailpipe emissions from mining equipment and other vehicle traffic inside the mine permit area. Blasting to remove overburden can result in emissions of nitrogen dioxide (NO_2), because of the incomplete combustion of explosives used in the blasting process. The Buckskin Mine does not use cast blasting to move overburden, which is the most common source of blasting emissions. No NO_x point sources occur at the Buckskin Mine.

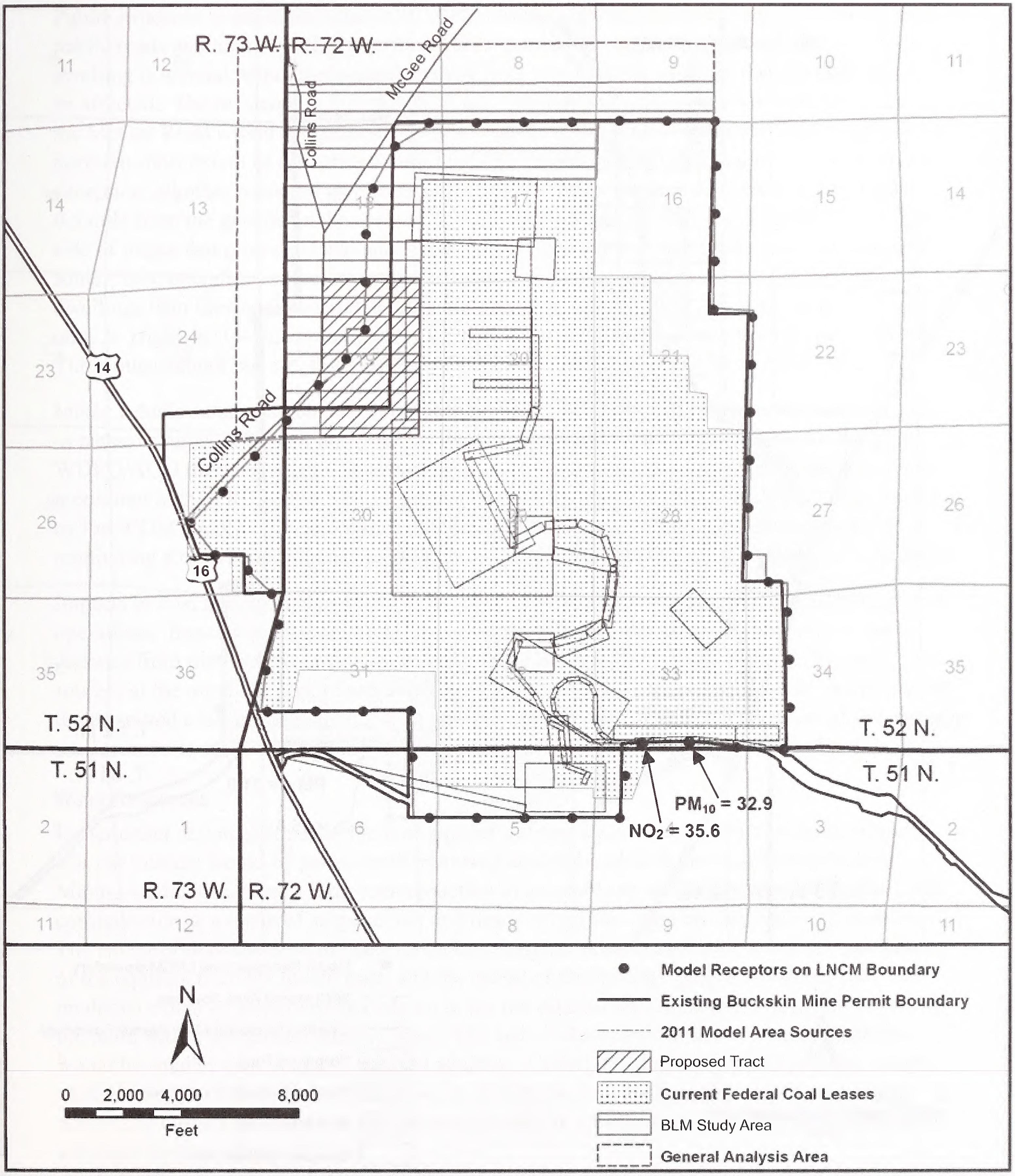
Non-mining air pollutant emission sources are also present within the region, though most (i.e., fugitive dust and tailpipe and exhaust emissions) are similar to those at the coal mines. Nitrogen oxides and sulfur dioxide are also generated at power-plants. The closest coal-fired power plants are the Wyodak, WYGEN, and Neil Simpson plants, located about 15 miles southeast of the general analysis area. The Dry Fork Station, a 420-megawatt, coal-fired power plant currently under construction, is located approximately 10 miles southeast of the area.

The currently regulated particulate pollutant in Wyoming is PM_{10}, which has been monitored at the mines since 1989. In 2000, Wyoming adopted a standard for $PM_{2.5}$ (particulate matter with a

mean aerodynamic diameter of 2.5 microns or less), but that standard is not yet part of the state's air quality monitoring requirements. The current National Ambient Air Quality Standard (NAAQS) for 24-hour PM_{10} is 150 micrograms per cubic meter ($\mu g/m^3$), whereas Wyoming implements an annual PM_{10} ambient air quality standard of 50 $\mu g/m^3$. The NAAQS for annual NO_2 is 100 $\mu g/m^3$. This gas is not currently regulated at surface coal mines by either national or state ambient air quality standards, though the WDEQ Air Quality Division (AQD) does require an assessment of annual NO_x impacts as part of an air quality permitting analysis for new surface coal mines and existing mine plan revisions.

Moderately adverse, short-term impacts on air quality are currently present at the Buckskin Mine due to existing mine operations, and would continue for two to up to six years under the action alternatives. Long-term modeling for the current Buckskin Mine permit did not forecast any exceedances of the annual PM_{10} particulate NAAQS at the permitted production rate of 42 million tons per year; Buckskin's current and anticipated production rates are 25 million tons per year. Results from the Buckskin Mine 24-hour PM_{10} monitors surpassed the 24-hour national annual average standard (150 $\mu g/m^3$) on only three occasions since monitoring began in 1989. Two of the three exceedances were deemed an "exceptional event" associated with strong winds by the WDEQ/AQD. The dispersion model for the lands necessary to conduct mining at Buckskin (map ES-4A) showed a maximum PM_{10} concentration of 32.9 $\mu g/m^3$ in 2011, one of two projected "worst-case" years used for the model. Map ES-4B shows the same modeling information for 2012. Both maps also depict the area sources used to model fugitive emissions.

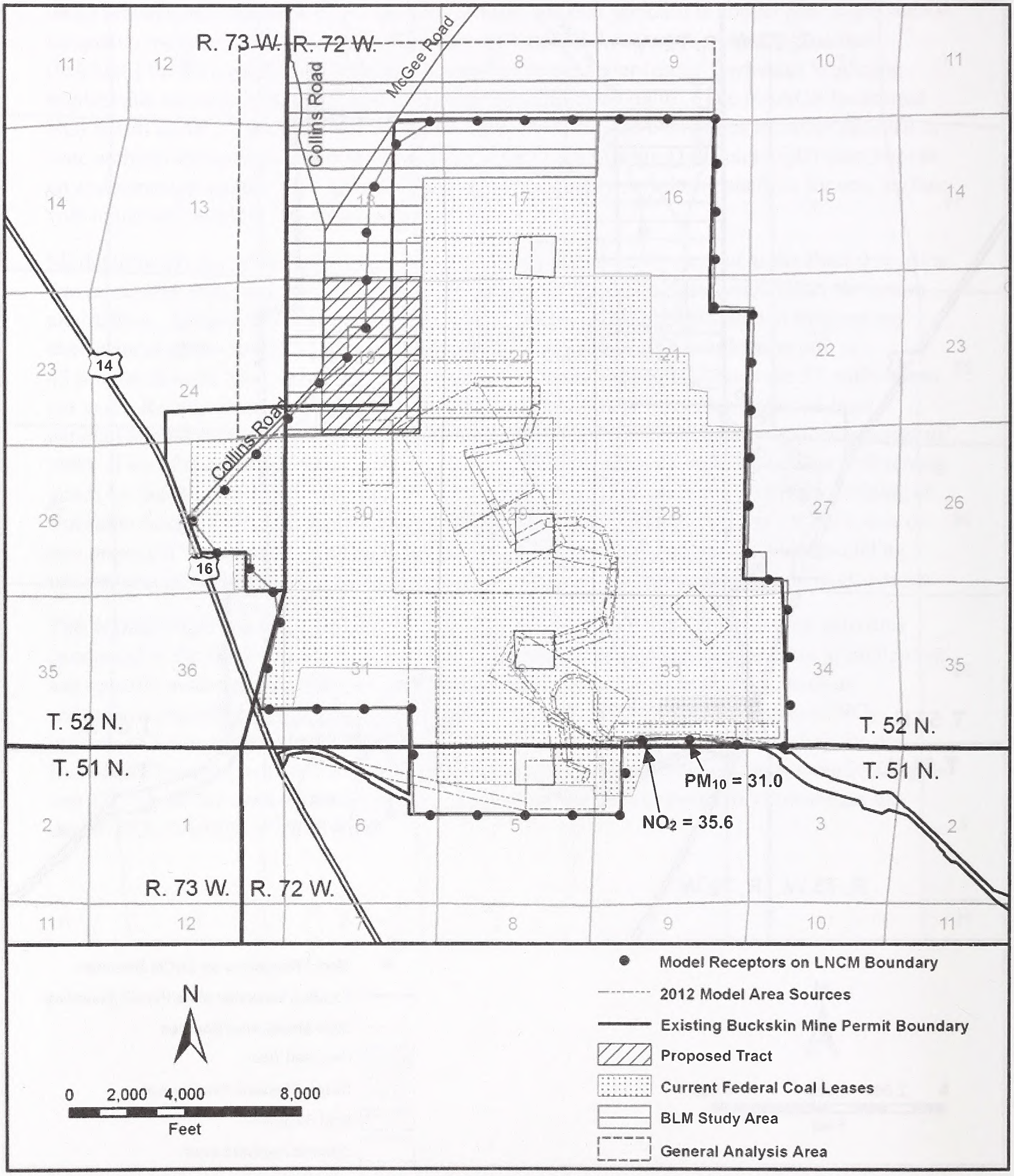
The WDEQ/AQD has received no reports of public exposure to NO_2 from blasting activities conducted at the Buckskin Mine. Therefore, the agency has not required Buckskin to implement any specific measures to control or limit public exposure to NO_2 from blasting, such as restrictions regarding blasting size, setbacks, or other parameters. Maximum annual NO_2 impacts of 1.6 $\mu g/m^3$ in 2011 and 1.8 $\mu g/m^3$ in 2012 were predicted during modeling for the Buckskin Mine; predictions for regional sources and background concentrations were 38.0 $\mu g/m^3$ and 37.8 $\mu g/m^3$ for these respective years. All four values were considerably lower than the annual NO_2 NAAQS of 100 $\mu g/m^3$.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-4A

2011 Maximum Modeled PM_{10} and NO_2 Concentrations for Buckskin Mine Ambient Air Boundary



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-4B

2012 Maximum Modeled PM_{10} and NO_2 Concentrations for Buckskin Mine Ambient Air Boundary

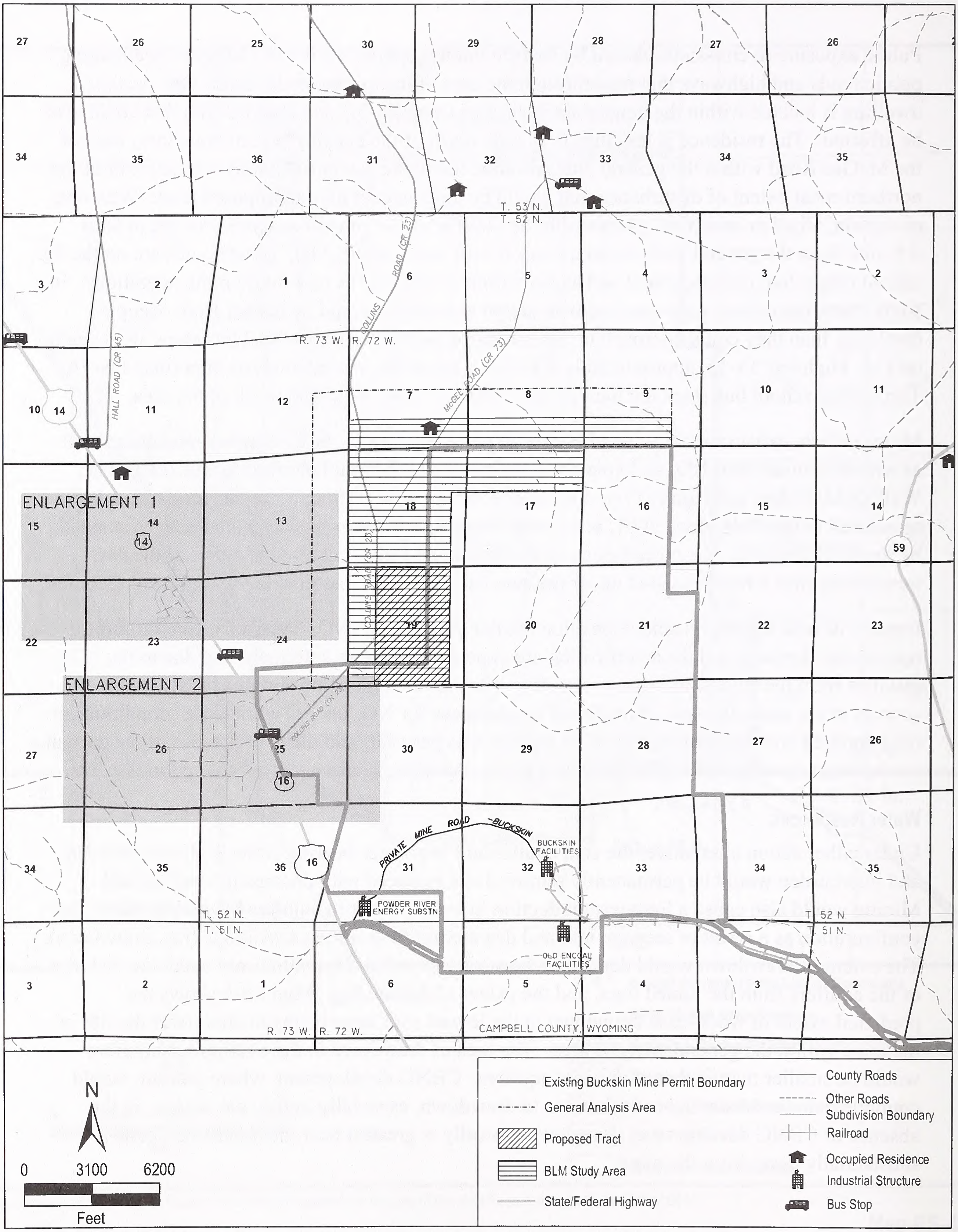
Public exposure to emissions caused by surface mining operations is most likely to occur along public roads and highways that pass through the area of the mining operations. One occupied dwelling is located within the general analysis area (map ES-5A and map ES-5B) that could also be affected. The residence is less than 0.25 mile north of the existing permit boundary, west of the McGee Road within the general analysis area; the home is approximately 1 mile north of the northern-most extent of disturbance that would be associated with the proposed tract. With one exception, all other occupied dwellings in the vicinity of the general analysis area are at least 0.5 mile from the general analysis area (map ES-5A and map ES-5B). Most homes are on the far side of ridges that provide visual and audio buffers from existing and future mine operations. In some cases, operations associated with an action alternative would be farther from occupied dwellings than they could encroach under existing conditions. Two school bus stops are located on U.S. Highway 14-16, approximately 0.5 mile west of the general analysis area (map ES-5A). Three other school bus stops are located more than 1.5 miles west and north of the area.

Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_x and volatile organic compounds that help form ozone (O_3). The WDEQ/AQD does not require O_3 monitoring at the Buckskin Mine; however, levels have been monitored in the PRB, since 2001, at ambient air quality monitor sites operated and maintained by the WDEQ/AQD. No exceedances of the O_3 standard have occurred at either of the two monitoring sites when evaluated under the standard in place at the time the values were recorded.

Impacts of coal mining on acid deposition are due primarily to NO_x emissions from mining operations. Impacts on lake acidification are expected to remain extremely low due to the distance from the Buckskin Mine to sensitive lakes in the region, the absence of NO_x point sources at the mine, the lack of predicted exceedances for NO_x under "worst-case" conditions at the permitted coal production rate of 42 million tons per year, and the continuation of the current production rate of 25 million tons per year under any of the alternatives considered in this EIS.

Water Resources

Under either action alternative, the coal aquifer and any water-bearing strata in the overburden and interburden would be permanently removed and replaced with unconsolidated backfill. Mining would also cause a long-term reduction in groundwater in aquifers beyond the final tract configuration as a result of seepage into and dewatering from mine excavations (i.e., drawdown). The extent of drawdown would depend on how long the mine excavations are open, the distance of the aquifers from the mined tract, and the extent of dewatering. Map ES-6 shows the predicted extent of worst-case drawdown in the lowest coal seam (Canyon coal) over the life of the mine within the general analysis area. The area of drawdown in the overburden aquifers would be smaller than in that of the coal aquifers. CBNG development, where present, would continue to have substantial contributions to drawdown, especially in the coal seams. In the absence of CBNG development, drawdown typically is greatest near the mine, and decreases substantially away from the mine.



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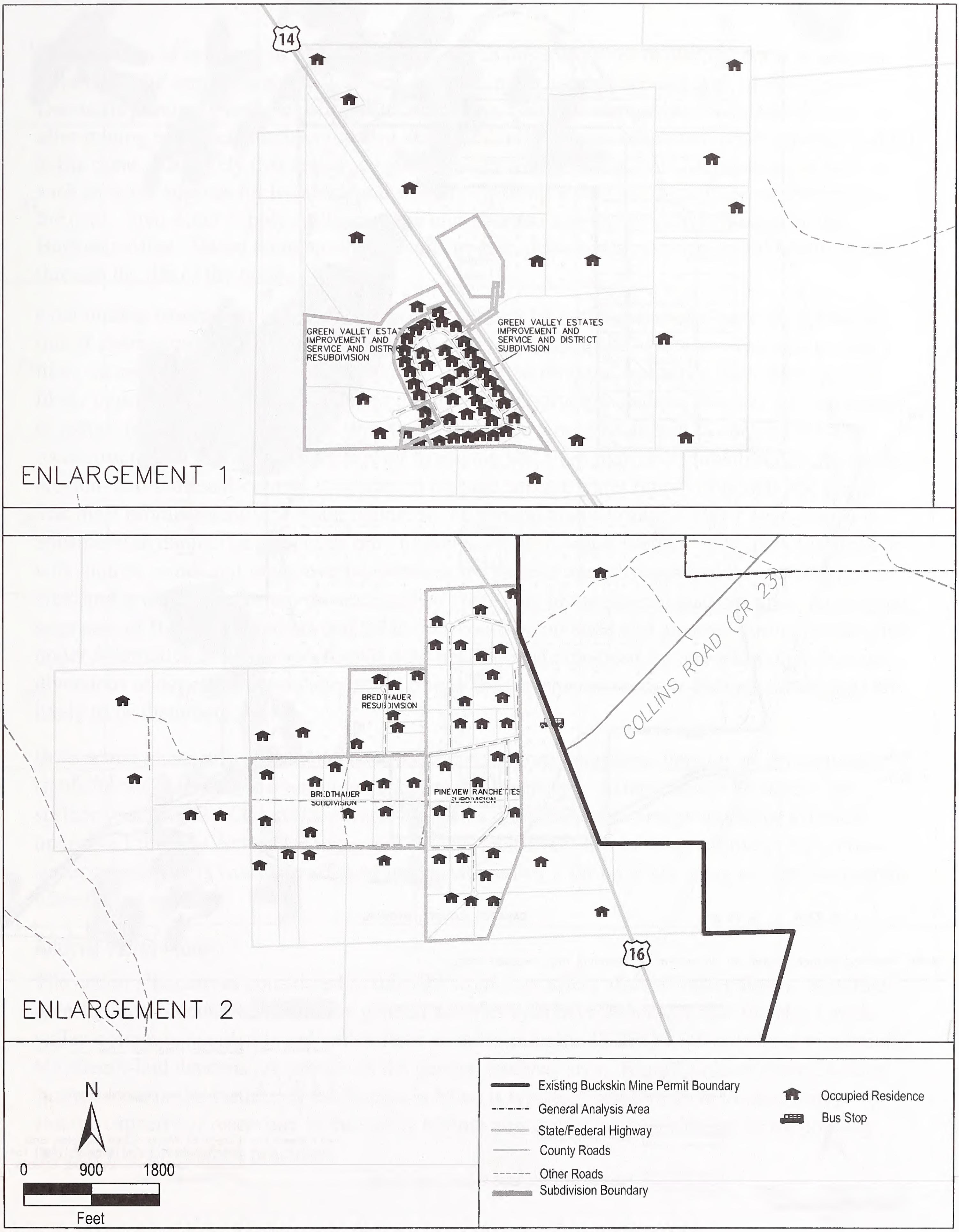
Map ES-5A
Roads, Highways, Occupied Dwellings, Businesses, and School Bus Stops in the Vicinity of the General Analysis Area



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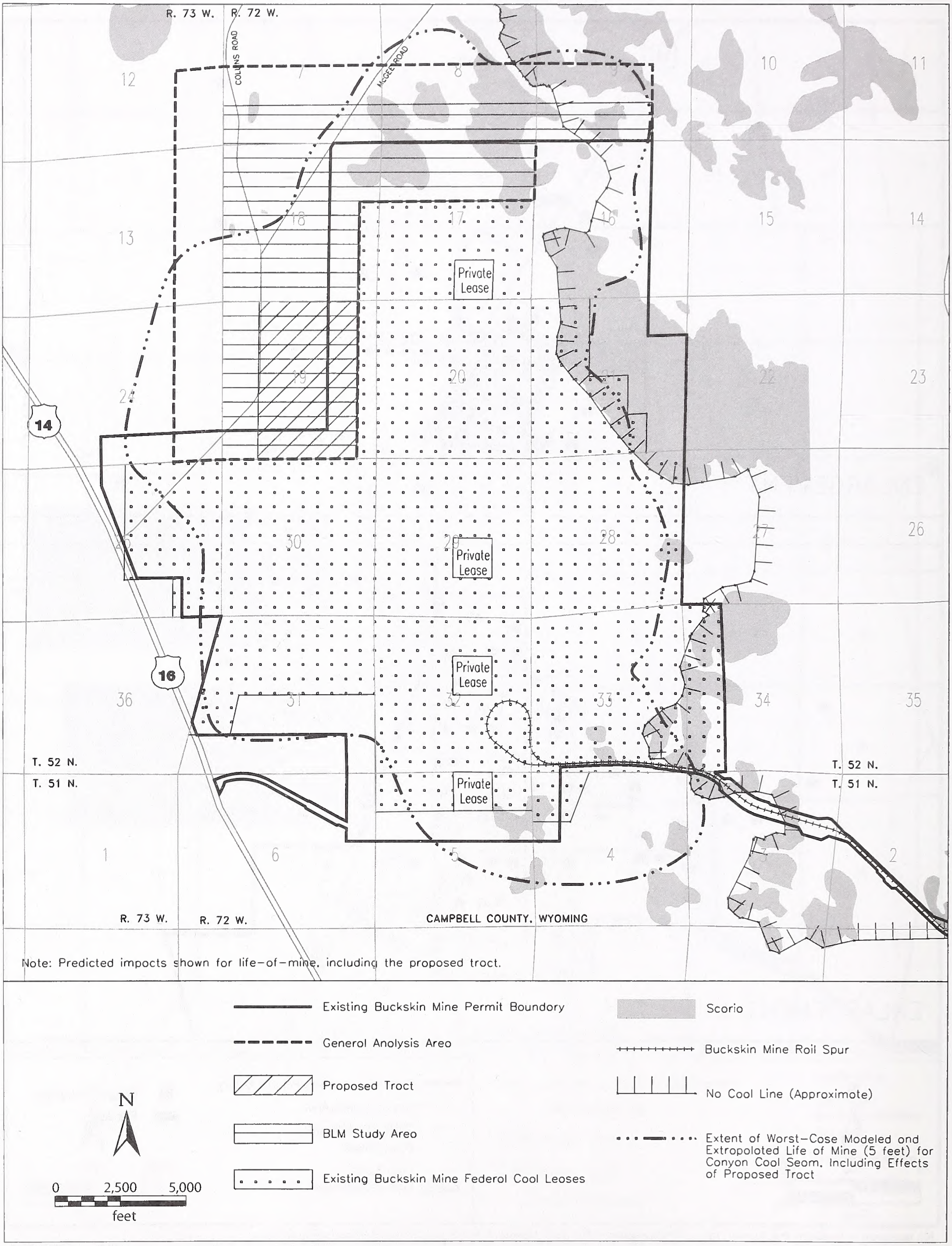
Map ES-5B

Enlargement—Roads, Highways, Occupied Dwellings, Businesses, and School Bus Stops in the Vicinity of the General Analysis Area



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map ES-6
Extent of Drawdown under Proposed Action

Groundwater is expected to rise to similar levels as observed prior to mining, but it would not have all of the same characteristics because of the more homogeneous nature of the backfill. Due to its proximity to the existing Buckskin Mine, groundwater quality in the backfill aquifer after mining is expected to be similar to that measured in wells completed in the existing backfill at the mine. It is likely that recharged groundwater would be adequate for postmining land uses such as water sources for livestock and wildlife. Mining would not disturb the aquifers below the coal. Two water supply wells from the underburden aquifer are currently used by the Buckskin Mine. Based on monitoring results to date, these wells currently could remain viable through the life of the mine.

Coal mining would have significant temporary effects on surface drainage systems and water runoff characteristics under either action alternative. Erosion and sediment discharge would likely increase in disturbed areas because of vegetation removal, but infiltration rates would likely improve after reclamation due to changes in soil structure and the presence of vegetation to reduce runoff. Water flow and direction in that area would be altered by the removal and reconstruction of drainage channels prior to mining and from redirected flow through the use of erosion- and sediment-control structures to manage surface water runoff from disturbed areas. The most prominent surface water feature in the general analysis area is Hay Creek, which is ephemeral in nature (i.e., responds only to rainfall or snow-melt events). The creek has been or will soon be mined out in the overlap between the general analysis area and the existing permit area, and is diverted to rejoin the undisturbed creek east of the general analysis area. Additional segments of Hay Creek and several tributaries could be diverted and restored during reclamation under Alternative 2. However, Kiewit does not anticipate the need for any additional channel diversions under either action alternative due to the fact that no roads or occupied dwellings are likely to be disturbed.

Both action alternatives would result in moderate, adverse long-term impacts on groundwater rights for wells in coal or overburden aquifers until recharge. Affects would be similar for surface water rights. One surface water right on a disconnected drainage would be affected under the Proposed Action for two years beyond the current life-of-mine estimate. Up to two surface water rights would be affected under Alternative 2 for up to six years beyond the current life-of-mine estimate.

Alluvial Valley Floors

The action alternatives considered in this EIS would not affect alluvial valley floors. Multiple investigations conducted within the general analysis area have concluded that the Hay Creek valley bottom is not an alluvial valley floor as defined by the WDEQ/LQD rules and regulations. No stream-laid deposits are present in the general analysis area. Runoff volume from 24-hour storm events in the vicinity of the Buckskin Mine is typically small relative to the cumulative storage capacity of reservoirs in the valley bottom and would not be sufficient to support any reliable flood irrigation practices.

Wetlands

Wetland inventories were based on U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping (USFWS 2007) and a reconnaissance-level field visit throughout the general analysis area. Based on the NWI maps, approximately 64.44 acres of wetlands have been identified in the general analysis area. Of these, 30.7 acres were determined to be potentially jurisdictional wetlands based on field observations; the remaining 33.74 acres were initially determined to be nonjurisdictional non-wetlands (e.g., borrow pits, old impoundments) or no longer present. Only the U.S. Army Corps of Engineers has the authorization to determine which wetlands are jurisdictional or nonjurisdictional. A formal wetland inventory and delineation for the portion of the general analysis area that is outside the current mine permit area will be completed as part of future permitting efforts. The specific functions (e.g., agriculture, livestock, and wildlife) of each identified wetland will be determined during that delineation process, and are, therefore, not addressed in detail as part of the EIS analysis.

Under the Proposed Action, surface mining would have minor, short-term direct impacts on two NWI inventoried wetlands for a total of approximately 0.48 acre. Under Alternative 2, surface mining could have moderate, short- to long-term impacts on up to 30.7 noncontiguous acres of 12 NWI inventoried wetlands. However, the greatest acreage is west of one or both county roads in the area considered operationally limited by Kiewit; Kiewit does not anticipate relocating either road to access coal reserves. All wetland functions would be lost during mining activities; mitigation will be provided to ensure no net loss of wetlands, in accordance with permit requirements. No additional reaches of Hay Creek would be diverted under either action alternative.

Soil Resources

Five soil formation processes causing different soil types were noted in the general analysis area. Soil types and depths in the general analysis area are similar to soils currently being salvaged and used for reclamation at the Buckskin Mine and other nearby mines in northern Campbell County.

Surface mining would have a direct, long-term effect on soil resources in 478 acres under the Proposed Action and up to 2,847 acres under Alternative 2. Some impacts would occur in the buffer around the final tract configuration associated with mining support activities. Mining in the general analysis area would cause changes to the physical, biological, and chemical properties of the soil resources. Following reclamation, replaced soils would be more uniform in type, thickness, and texture, and would have a more uniform soil chemistry and soil nutrient distribution. Infiltration rates would gradually return to premining levels. Sediment-control measures would be implemented where runoff occurs to preserve reclaimed materials. Average topsoil quality would be improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. The replaced soil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (i.e., wildlife habitat and livestock grazing).

Vegetation Resources

Eight distinct vegetation communities were identified and mapped in the general analysis area. The proposed tract is dominated (71%) by a variety of common species of upland grasslands; the general analysis area is dominated (71%) by upland grasslands (approximately 40.4%, combined) and agricultural lands (crops, hay fields, and pastures; approximately 30.5%). Sagebrush comprises less than 11% of both the proposed tract and the general analysis area.

Under either action alternative, impacts on vegetation during mining would result from active mining and mine-support activities, and would be moderate and short-term. Vegetation would be temporarily and incrementally removed to accommodate mining. Impacts would be greatest on upland grasslands and agricultural lands. Impacts associated with the removal of vegetation could include increased soil erosion and differences between premining and postmining vegetative communities. Reclamation, including revegetation, will immediately follow as mining progresses through the area. Estimates of the time elapsed from topsoil stripping through reseeding of any given area range from two to five years; that time-frame would be considerably longer for areas occupied by mine-related facilities and infrastructure.

Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures, which are approved by the WDEQ/LQD. The majority of these species would be native to the general analysis area. Erosion will be monitored to determine if corrective action is needed during establishment of vegetation. Controlled grazing will be used during revegetation as a management tool and to determine the suitability of the reclaimed land for postmining land uses. Any decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity.

Wildlife Resources

Under either action alternative, direct impacts of surface coal mining on wildlife would occur during mining and would be short-term. They include: injuries or mortalities causes by mine-related traffic; direct losses of less mobile wildlife species; restrictions on wildlife movement created by fences, spoil piles and pits; displacement of wildlife from existing habitat in areas of active mining (including abandonment of nests or nesting and breeding habitat for birds); increased competition between animals in areas adjacent to mining operations; and increased noise, dust, and human presence.

Little (less than 1% of total area) aquatic habitat is present in the general analysis area, so few aquatic species would be lost during mining operations. Indirect impacts are longer-term and include alterations in topography and vegetative cover following mining and reclamation, which may decrease wildlife carrying capacity and habitat diversity. Because the general analysis area is dominated (71% combined) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats for most wildlife species compared to those in the premining landscape.

The general analysis area does not include any unique or crucial big game habitat; and habitat disturbance would be incremental, with reclamation progressing as new disturbance occurs. No bald eagle nests or winter roosts have ever been documented in the general analysis area or surrounding lands; sightings of this species in the vicinity of the general analysis area have averaged only 0.5 per winter over the last 25 years. No mountain plovers have ever been documented in the vicinity of the general analysis area during that period. Additionally, typical suitable habitat (short and sparse vegetation) for this species is not present in the area. None of the 18 migratory bird species of management concern for Wyoming coal mines that have historically been observed in the vicinity are regularly seen in the general analysis area. The upland grasslands and agricultural lands that dominate the area lack the specific characteristics (shrubs, wetlands, prairie dog colonies, or shorter, less dense grasses) typically associated with the species of greatest concern.

Up to three intact raptor nests could be impacted in the general analysis area. Due to their respective locations and histories, only one of the three intact nests is likely to be impacted by future mining operations under either action alternative. That nest is in a tree grove in the overlap between the general analysis area and the existing permit area and, thus, is already subject to disturbance from previously permitted mine operations. All appropriate mitigation measures will be taken for that nest, in keeping with the current USFWS-approved monitoring and mitigation plan.

No sage-grouse leks have been documented in the general analysis area over the last 25 years of annual monitoring. The nearest sage-grouse lek (Hay Creek) is within the existing permit area approximately 0.5 mile to the southeast and, thus, is already subject to disturbance from previously permitted activities. The McGee sage-grouse lek is on private surface approximately 1.25 miles north of the general analysis area. That site is on the far side of multiple ridges that provide a visual and audio buffer, and it is not likely to be affected by mine operations. The Daly sage-grouse lek is approximately 1.75 miles southwest of the general analysis area; that lek has been inactive for the last 16 consecutive years and is considered abandoned by the WGFD (2006). Sage-grouse were last observed at the Hay Creek lek in 2001 and the McGee lek in 2004; both are considered occupied by the WGFD (2006).

Two occupied sharp-tailed grouse leks occur within the general analysis area. The McGee II lek is in the overlap area with the current permit area and the McGee III lek is immediately north of the overlap area (Alternative 2). Due to their locations, those leks have been or would be disturbed by previously permitted mining of existing leases. The McGee I sharp-tailed grouse lek is approximately 0.25 mile north of the general analysis area. It would not be in view of the general analysis area due to the ridgeline that separates the two sites, but it could be affected by noise from within the general analysis area. The Stickel lek is approximately 0.75 mile southeast of the general analysis area and within the existing permit area; this site has been or would be disturbed by previously permitted activities on existing leases. Sharp-tailed grouse were last recorded at the McGee II lek in 2004 and the McGee III lek in 2005. The McGee I lek was last active in 2001, and the Stickel lek in 2002.

As described previously, the prevalence of upland grasslands and the limited presence of surface water reduce the area's value to sagebrush obligates such as the sage-grouse. No grouse nests or broods for either species have been recorded in the general analysis area during targeted surveys or incidental to surveys for other species. No sage-grouse have been observed during winter, though site visits occur less often at that time of year. No sharp-tailed grouse have ever been observed on the proposed tract during any season, though flocks of as many as a dozen birds have infrequently been recorded in the general analysis area, feeding in fallow agricultural fields and perched in the tree shelterbelt near the junction of the Collins and McGee county roads in winter. No sharp-tailed grouse have been seen in those locations since at least 2003.

The general analysis area is not included in or adjacent to any sage-grouse core breeding areas, as defined by the Governor of Wyoming's Sage-Grouse Implementation Team (Sage-Grouse Implementation Team 2008). The sage-grouse lek with the most recent (2004) activity is approximately 1.25 miles from and beyond view of the general analysis area. The sharp-tailed grouse lek with the most recent (2005) activity is immediately north of that general analysis area.

In the long term, following reclamation, wildlife habitat diversity may be somewhat reduced due to gentler topography, less diverse vegetative cover, and reduction in sagebrush density. However, sagebrush comprises less than 11% of the general analysis area, so impacts on sagebrush-obligates would be reduced. Efforts have been initiated in recent years by mining companies to increase the diversity of postmine topography and to increase the amount of sagebrush in the reclamation, as appropriate.

Threatened and Endangered Species

The action alternatives discussed in this EIS will have no effect on threatened and endangered plant and animal species.

Three such species occur in Campbell County: the Ute ladies'-tresses orchid, blow-out penstemon, and black-footed ferret. Areas of suitable habitat for the Ute ladies'-tresses orchid within the general analysis area were surveyed during the appropriate survey window in August 2004 and annually from 2006 through 2009; no individuals were located. Surveys conducted for potential blowout penstemon habitat in the general analysis area in 2008 and 2009 confirmed that no suitable habitat for this species is present in the area. In addition, the general analysis area is not located within the documented historical range of the blowout penstemon in Wyoming, which is located approximately 170 miles northwest of the known Nebraska sites and approximately 225 miles northeast of the Wyoming occurrences.

The black-footed ferret is a nocturnal mammal that depends almost entirely upon the prairie dog for its survival. No black-footed ferrets have ever been documented at the Buckskin Mine or in the surrounding region, and no black-tailed prairie dog colonies (potential ferret habitat) are present within the general analysis area.

Land Use and Recreation

The entire surface of the existing Buckskin Mine permit area and general analysis area is privately owned by individuals or companies, while most of the subsurface minerals (all of the coal and the majority of oil and gas reserves) are federally owned. Wildlife habitat and livestock grazing are the primary present and historical land uses in the general analysis area. Secondary land uses include pastureland (ranching), dryland cropland, transportation, and CBNG development. All CBNG production facilities located in the proposed tract are privately owned; facilities in the rest of the general analysis area under a mix of federal and private ownership. Coal mining at the Buckskin Mine is and has been the dominant land use to the east and south of the general analysis area since the mid-1980s. No conventional oil and gas wells are located in the general analysis area.

Under both action alternatives, active mining would have minor to moderate short-term impacts on most other land uses. Grazing uses of the general analysis area would be more limited in disturbance areas during mining, though grazing is used as a management tool in reclaimed areas. Oil and gas development would be curtailed and CBNG that is not recovered prior to mining would be irretrievably lost as the coal is removed. Due to the lack of public lands, opportunities for recreational use and public grazing would not be affected. Existing coal and transportation activities, infrastructure, and facilities would remain in the area; coal production and transportation would continue at their current rates. Kiewit does not anticipate relocating any roads or securing occupied residences to access new coal reserves. Within 10 years after initiation of each reclamation phase, rangeland and wildlife use is expected to return to near premining levels.

Cultural Resources

The entire general analysis area has been reviewed for previous cultural surveys at the Class I level, and inventoried for cultural resources at a Class III level. Of the 14 sites identified in that area, 6 are prehistoric and 8 are historic (Newberry 2008). Historic site categories documented in the general analysis area fall under the context of rural settlement. Specifically, the historic sites in the general analysis area are associated with homesteading and stock-raising circa the 1910s to the 1940s. All prehistoric and historic sites are determined not eligible for inclusion in the National Register of Historic Places. No further protection is afforded these sites and no further work is required.

No sites of Native American religious or cultural importance have been identified in the general analysis area. Appropriate action must be taken to address concerns related to any cultural or Native American sites identified at a later date.

Visual Resources

Mining activities in the general analysis area would be visible from U.S. Highway 14-16 and two county roads (Collins and McGee Roads), though the extent and duration of visibility would vary under the three alternatives analyzed. In some cases, future operations would be farther from these roads than allowed under existing conditions. Mining would affect landscapes classified

by BLM as visual resource management Class IV, and the landscape character would not be significantly changed following reclamation. No unique visual resources have been identified in or near the general analysis area.

Noise

One occupied residence is located within the general analysis area, less than 0.25 mile north of the existing mine permit area. This residence is in direct line-of-sight of the current mine pit and associated support activities (e.g., topsoil stripping, soil stockpiling), and will experience increased noise levels under Alternative 2. Noise associated with the Proposed Action would be farther from the home than currently allowed under existing conditions. Mine-related noise would continue for up to six additional years beyond the current life-of-mine estimate, depending on the size of the final tract configuration.

Most occupied dwellings are located in one of three housing developments west of the existing permit area and on the far side of Highway 14-16. Those residences are currently closer to the existing permit area than they would be to new mining under either action alternative. The high rolling terrain between most residences and the general analysis area provides a visual and audio buffer from current and future mine operations. Additionally, the increase in noise levels would not be considered a significant noise impact because the rate of mining would not change and the western limit of expansion of the mine would be constrained due to the required setbacks at the Collins Road and Highway 14-16.

Noise levels in wildlife habitat adjacent to the expansion area might increase, but anecdotal observations indicate wildlife can adapt to mine noise, especially since similar mining operations have been conducted in the area for many years. No increase in average daily railroad traffic or railroad noise would occur under any of the alternatives analyzed.

Transportation

Transportation facilities in and near the general analysis area include a U.S. highway, a state highway, two gravel county roads, various unimproved local and access roads; the improved Buckskin Mine access road; the Buckskin Mine rail spur; oil and gas pipelines; electric corridors; and associated rights-of-way.

Under the Proposed Action, surface coal mining in the proposed tract could impact one public roadway, two overhead power lines, and three oil and gas pipelines. Under Alternative 2, mining could impact two public roadways, eight overhead power lines, and five oil and gas pipelines. Most of the power lines in the vicinity are associated with on-going mine operations. No rail lines would be affected under either action alternative. Temporary surface disturbance from mine support activities (e.g., topsoil stripping, soil stockpiling) in the combined buffer area could affect one additional power line and three additional pipelines.

Existing road and rail infrastructure would remain in place for up to six years beyond the current life-of-mine estimate, depending on the size of the final tract delineation. Vehicular traffic levels to and from the mine would also continue for up to six years additional years, though the rate of

road and rail use is not expected to increase during that period. Two public roads (Collins and McGee roads) are located within the general analysis area. Lands within 100 feet of the outside edge of the right-of-way of a public road are considered unsuitable for mining; however, they could be included in the final tract configuration to allow for maximum recovery of all the minable coal adjacent to the 100-foot buffer zones. Active pipelines and utility/power lines would have to be relocated in accordance with previous agreements, or agreements would have to be negotiated for their removal or relocation.

Hazardous and Solid Waste

Potential sources of hazardous or solid waste could include spilled, leaked, or dumped substances, petroleum products, and solid waste associated with coal and oil and gas exploration, oil and gas development, utility line installation and maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present in the general analysis area.

Impacts associated with hazardous waste would be negligible and short-term. Hazardous and solid wastes generated in the course of mining the proposed tract would be similar to those currently being created by existing mining operations, but they would continue for two years beyond the current life-of-mine estimate under the Proposed Action, and up to six years beyond that estimate under Alternative 2. Wastes generated by mining the proposed tract would be handled in accordance with the existing regulations using the procedures currently in use, and in accordance with WDEQ/LQD-approved waste disposal plans at the Buckskin Mine

Socioeconomics

Both action alternatives would have negligible beneficial impacts on local employment; current employees would be retained but no new hires are expected. Impacts on federal and state revenues would be substantial and beneficial under both action alternatives, and would be extended from two to six years beyond the current life-of-mine estimate, depending on the final tract configuration. The potential additional federal revenue from the general analysis area would range from approximately $69 to $241 million, depending on the alternative selected and the bonus price when the coal is leased. The potential additional revenue to the state of Wyoming from the general analysis area would range from $91 to $300 million, depending on the alternative selected, the bonus price when the coal is leased, and the selling price of the coal. Because average annual coal production rates would not increase, no new employees would be hired and therefore no new impacts on the local housing market or increased demands on the existing community facilities or services in the county would occur.

Environmental Justice

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level comprise a "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole. Also, the Native American population is smaller than in the state as a whole and no known Native American sacred sites are present in or near the general analysis area.

Greenhouse Gas Emissions

The annual Equivalent carbon dioxide (CO_2Eq) emissions at the Buckskin Mine are not expected to increase under either action alternative. The maximum annual coal production would not be affected; average strip ratios and haul distances would be substantially equivalent to those already encountered at the mine. Conversely, projected CO_2Eq emissions over the life of the mine would increase under either action alternative. Although annual average production is not expected to increase, the additional coal reserves would extend the mine life by approximately two years under the Proposed Action and up to six years under Alternative 2, which would also extend the period for associated CO_2Eq emissions. The 2008 Buckskin Mine emissions total represents 0.33% of the 2010 statewide CO_2Eq emissions.

Carbon Sequestration

Carbon sequestration, the process of carbon capture, separation, and storage or reuse, is being researched as a means to stabilize and reduce concentrations of carbon dioxide (CO_2), a greenhouse gas. Direct options for carbon sequestration would involve means to capture CO_2 at the source (e.g., power plant) before it enters the atmosphere coupled with "value-added" sequestration (e.g., use of captured CO_2 in enhanced oil recovery operations). Indirect sequestration would involve means of integrating fossil fuel production and use with terrestrial sequestration and enhanced ocean storage of carbon (U.S. Department of Energy 2007a). The PRB has geologic formations and producing oil and gas reservoirs that are potential target candidates for both enhanced oil recovery and/or deep geologic sequestration. The current limiting factor is the lack of pipeline infrastructure and economic feasibility for CO_2 transmission and use. No geologic carbon sequestration projects currently exist or are currently planned in the PRB at this time.

Mitigation

The Buckskin Mine's currently approved mining permit includes extensive baseline information, ongoing monitoring information and commitments, and mitigation measures that are required by the SMCRA and Wyoming State Law. Compliance, mitigation, and monitoring measures that are required by regulation are considered to be part of the Proposed Action and Alternative 2 considered in this EIS. These regulatory requirements, mitigation measures, and monitoring commitments are in place for the No Action Alternative as part of the currently approved mining and reclamation plan for the mine and would be included in the permitting process that would be required to mine the final tract configuration.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, the BLM can include additional mitigation measures, in the form of stipulations on a new lease, within the limits of its regulatory authority. Any special stipulations identified by the BLM where additional or increased monitoring measures are recommended to be added to the BLM leases are included in appendix D of the EIS.

Cumulative Impacts

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

Since decertification of the Powder River Federal Coal Region in 1990, 20 coal leases containing more than 5.8 billion tons of federal coal have been issued following competitive sealed-bid sales. Three exchanges of federal coal in the Wyoming portion of the Powder River Federal Coal Region have also been completed. Thirteen additional coal lease applications, including the Hay Creek II coal lease application, are currently pending. The pending LBA applications contain over 3.8 billion tons of coal.

Currently, the BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The study evaluates current conditions as of a baseline year (2002 or 2003) and projects development levels and potential associated cumulative impacts related to coal and coal-related development, oil and gas and related development, and other development through 2020. Due to variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed. The projected development levels are based on projected demand and coal market forecasts and include production at the Buckskin Mine during the baseline year and projected production for 2010, 2015, and 2020.

The Wyoming portion of the PRB is the primary focus of the PRB Coal Review, but the Montana portion of the PRB is included in some studies. Results for those PRB Coal Review studies that have been completed are summarized in chapter 4.0 of the EIS. The remaining studies will be incorporated into the final report as they become available.

Cumulative impacts vary by resource, with potential impacts on air quality, groundwater quantity, wildlife habitat, and socioeconomics generally representing the greatest concerns.

The original PRB Coal Review air quality study documented the modeled air quality impact of existing operations during a baseline year, 2002, and of projected development activities in 2010. BLM updated the model in 2008 and conducted the cumulative air quality impact analysis using a revised baseline year of 2004 with development levels projected for year 2015. The model was used to evaluate impacts of baseline and projected source emissions on several source groups, including near-field receptors in Wyoming and Montana, receptors in nearby federally designated Class I areas, and receptors at Class II sensitive areas. The EPA guideline CALPUFF model system was used for the modeling analysis.

The existing regional air quality conditions are generally very good, but the modeling showed substantial impacts at some receptors for years 2004 and 2015. The model results should not be construed as predicting an actual exceedance of any standard, but are at best forecasts that indicate potential impacts. Table ES-2 presents the maximum modeled impacts on ambient air quality at the near-field receptors in Wyoming and Montana for 2004 and for the 2015 upper and lower coal development scenarios.

Table ES-2. Projected Maximum Potential Near-Field Impacts (µg/m3)

Pollutant	Averaging Time	Base Year (2004) Impacts	2015 Lower Coal Development Scenario Impacts	2015 Upper Coal Development Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
WYOMING NEAR-FIELD								
NO_2	Annual	31.3	46.7	47.4	100	100	—[1]	25
SO_2	Annual	15.3	16.2	16.2	80	60	—	20
	24-hour	112.3	119.6	119.6	365	260	—	91
	3-hour	462.0	814.1	814.1	1,300	1,300	—	512
$PM_{2.5}$	Annual	13.4	**18.7**	**21.4**	15	15	—	—
	24-hour	**87.6**	**179.5**	**179.5**	35	35	—	—
PM_{10}	Annual	38.4	**53.5**	**61.0**	—	50	—	17
	24-hour	**250.4**	**512.8**	**512.9**	150	150	—	30
MONTANA NEAR-FIELD								
NO_2	Annual	3.3	6.5	6.5	100	—	100	25
	1-hour	409.0	**826.3**	**826.4**	—	—	564	—
SO_2	Annual	1.6	1.7	1.7	80	—	80	20
	24-hour	16.1	16.5	16.6	365	—	365	91
	3-hour	65.0	66.5	66.5	1,300	—	1,300	512
	1-hour	162.9	166.6	166.6	—	—	1,300	—
$PM_{2.5}$	Annual	1.0	1.8	1.9	15	—	15	—
	24-hour	10.2	15.4	20.6	35	—	35	—
PM_{10}	Annual	2.8	5.2	5.3	—	—	50	17
	24-hour	29.1	44.0	58.5	150	—	150	30

µg/m³ = microgram per cubic meter; NAAQS = National Ambient Air Quality Standards; AAQS = Ambient Air Quality Standards; PSD = prevention of significant deterioration; NO_2 = nitrogen dioxide ; SO_2 = sulfur dioxide; $PM_{2.5}$ = particulate matter 2.5 micrometers or less in diameter; PM_{10} = particulate matter 10 micrometers or less in diameter

[1] No standard or increment.

Bold values indicate projected exceedance of standards

Source: Powder River Basin Coal Review Task 3A Report (BLM 2008a)

Table ES-3 lists the projected modeled visibility impacts for 2004 for all analyzed Class I and sensitive Class II areas. For the upper and lower coal production scenarios, it shows the number of additional days that the impacts were projected to be greater than 1.0 deciview for each site in 2015.

Table ES-3. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas

	Base Year (2004)	2015 Lower Coal Development Scenario	2015 Upper Coal Development Scenario
Location	No. of Days >10%	Change in No. of Days >10%	Change in No. of Days >10%
CLASS I AREAS			
Badlands National Park	218	26	26
Bob Marshall Wilderness Area	8	0	0
Bridger Wilderness Area	144	2	2
Fitzpatrick Wilderness Area	91	2	2
Fort Peck Indian Reservation	105	10	10
Gates of the Mountain Wilderness Area	55	0	0
Grand Teton National Park	70	2	2
North Absaroka Wilderness Area	61	3	3
North Cheyenne Indian Reservation	243	32	47
Red Rock Lakes	42	2	2
Scapegoat Wilderness Area	27	1	1
Teton Wilderness Area	57	4	4
Theodore Roosevelt National Park	178	5	9
UL Bend Wilderness Area	77	8	10
Washakie Wilderness Area	83	5	5
Wind Cave National Park	262	18	19
Yellowstone National Park	84	2	2
SENSITIVE CLASS II AREAS			
Absaroka Beartooth Wilderness Area	101	2	3
Agate Fossil Beds National Monument	251	20	20
Big Horn Canyon National Recreation Area	331	1	3
Black Elk Wilderness Area	236	34	36
Cloud Peak Wilderness Area	126	18	18
Crow Indian Reservation	360	4	4
Devils Tower National Monument	274	25	25
Fort Belknap Indian Reservation	66	6	7
Fort Laramie National Historic Site	260	10	10
Jedediah Smith Wilderness Area	79	1	1

Location	Base Year (2004) No. of Days >10%	2015 Lower Coal Development Scenario Change in No. of Days >10%	2015 Upper Coal Development Scenario Change in No. of Days >10%
Jewel Cave National Monument	261	19	21
Lee Metcalf Wilderness Area	97	2	2
Mount Naomi Wilderness Area	51	1	1
Mount Rushmore National Monument	222	36	36
Popo Agie Wilderness Area	139	4	4
Soldier Creek Wilderness Area	268	18	18
Wellsville Mountain Wilderness Area	130	10	10
Wind River Indian Reservation	217	2	5

Source: Powder River Basin Coal Review Task 3A Report (BLM 2008a)

The PRB Coal Review provides an assessment of the cumulative impact on surface and groundwater resources associated with future projected levels of coal mining, coal mine dewatering, CBNG groundwater withdrawal and surface disposal, and coal mine and conventional oil and gas surface disposal of groundwater. The groundwater portion of the impact analysis has not yet been completed. The surface water analysis addresses the cumulative impacts on surface water quality and channel stability as a result of surface discharge of groundwater by CBNG development and coal mine dewatering. The surface water quality portion of this analysis has been completed, but the channel stability portion is not yet complete. A number of modeling analyses have previously been conducted to help predict the impacts of surface coal mining on groundwater resources in the PRB. In addition, each mine must monitor groundwater levels in the coal and underlying and overlying aquifers and assess the probable hydrologic consequences of mining as part of the mine permitting process. The monitoring programs track the extent of groundwater drawdown propagation to the west and the extent of recharge and quality of the water in the backfill areas of the mines. The monitoring data indicate that recharge is occurring in the backfill and that water from the backfill will generally be acceptable for premining uses (primarily livestock watering). Modeling and monitoring indicate that the groundwater drawdown impacts of coal mining and CBNG development are overlapping.

The PRB Coal Review studies include an evaluation of the impacts on wildlife and aquatic species as of 2003 and an evaluation of the projected levels of disturbance in the PRB in 2010, 2015, and 2020, based on the projected development levels in those years. As discussed above, impacts on wildlife and fisheries can be classified as no impact (threatened and endangered species), short-term, and long-term. Short-term impacts are related to habitat disturbance during mining and reclamation and through the time the reclamation bond is released. Long-term impacts result from changes in habitat after reclamation is completed. Habitat fragmentation can result from activities such as roads, well pads, mines, pipelines, and overhead electrical power lines, as well as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust from unpaved road traffic. The cumulative impacts of energy

development (coal mining, oil and gas) in the PRB contribute and will continue to contribute to a reduction in hunting opportunities for some animals, particularly big game, with lesser effects on species with limited hunting seasons, such as sage-grouse.

The PRB Coal Review used the Policy Insight regional economic model to project cumulative employment and population levels and associated impacts in the PRB for the upper and lower coal production scenarios in 2010, 2015, and 2020. Table ES-4 presents the recent and projected population levels for the counties included in the PRB Coal Review socioeconomic analysis.

Table ES-4. Recent and Projected Powder River Basin Population

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six County PRB Total
CENSUS							
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,438	12,314	5,986	7,554	27,115	6,671	95,078
2007	40,433	12,868	6,284	8,142	27,998	6,854	102,579
LOWER COAL PRODUCTION SCENARIO							
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
UPPER COAL PRODUCTION SCENARIO							
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

PRB = Powder River Basin

Source: U.S. Census Bureau (2007) and PRB Coal Review Task 3C Report (BLM 2005a).

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ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT

µeq/L	microequivalent per liter
µg/m^3	micrograms per cubic meter
AML	abandoned mine land
AQRV	air quality related value
AVF	alluvial valley floor
B.P.	before present
bcf	billion cubic feet
BLM	U.S. Bureau of Land Management
BNSF	Burlington Northern Santa Fe
Btu	British thermal units
C2P2	Coal Combustion Products Partnership
CAA	Clean Air Act
CBNG	coal bed natural gas
CCP	coal combustion product
CCSD	Campbell County School District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, as amended
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CO_2	carbon dioxide
CO_2Eq	equivalent carbon dioxide
Collins Road	Campbell County Road 23
Corps	U.S. Army Corps of Engineers
dB	decibel
dBA	A-weighted decibel
DM&E	Dakota, Minnesota and Eastern Railroad Corporation
DOE	U.S. Department of Energy
dv	deciview
EC	electrical conductivity
EIS	environmental impact statement

EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act of 1973, as amended
F	Fahrenheit
FLPMA	Federal Land Policy Management Act
FMR	federal mineral royalties
GAGMO	Gillette Area Groundwater Monitoring Organization
GHG	greenhouse gas
GSP	gross state product
Highway 14-16	U.S. Highway 14-16
Highway 59	Wyoming State Highway 59
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPCC	Intergovernmental Panel on Climate Change
Kiewit	Kiewit Mining Properties, Inc.
LBA	lease by application
L_{DN}	day-night noise levels
L_{eq}	equivalent noise level
LRPL	least restrictive proposed limit
McGee Road	Campbell County Road 73
mmgpy	million gallons per year
mmtpy	million tons of coal per year
MRPL	most restrictive proposed limit
MSHA	Mine Safety and Health Administration
MW	megawatts
NAAQS	National Ambient Air Quality Standards
NCDB	National Compliance Data Base
NEAP	Natural Events Action Policy
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NRHP	National Register of Historic Places

NWI	National Wetland Inventory
NWLSWG	Northeast Wyoming Local Sage-Grouse Working Group
O_3	ozone
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining Reclamation and Enforcement
P&M	Pittsburg and Midway Coal Mining Company
PM_{10}	particulate matter measuring 10 micrometers or less in diameter
$PM_{2.5}$	particulate matter measuring 2.5 micrometers or less in diameter
PRB	Powder River Basin
PRRCT	Powder River Regional Coal Team
PSD	prevention of significant deterioration
RMP	resource management plan
ROD	record of decision
RV	recreational vehicle
SAR	sodium adsorption ratio
SARA	Superfund Amendments and Re-authorization Act
SEO	State Engineeer's Office
SHPO	State Historic Preservation Office
SIP	state implementation plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
TDS	total dissolved solids
TEOM	Tapered Element Oscillating Microbalance
TSP	total suspended particles
UP	Union Pacific
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS CHIA	Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming
USNRC	U.S. Nuclear Regulatory Commission
VOC	volatile organic compound
VRM	visual resource management
WAAQS	Wyoming Ambient Air Quality Standards

WDEQ	Wyoming Department of Environmental Quality
WDEQ/AQD	Wyoming Department of Environmental Quality/Air Quality Division
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WDEQ/WQD	Wyoming Department of Environmental Quality/Water Quality Division
WGFD	Wyoming Game and Fish Department
WSO-RMG	BLM Wyoming State Office–Reservoir Management Group
Wyoming PRB Oil and Gas EIS	Final Environmental Impact Statement and Proposed Plan Amendment for the PRB Oil and Gas Project

1.0 INTRODUCTION

This environmental impact statement (EIS [1]) presents the analysis of impacts that would result from leasing federal coal reserves in the Hay Creek II lease by application (LBA) tract (Proposed Action). The EIS also analyzes alternatives to the Proposed Action.

This EIS was prepared in accordance with the National Environmental Policy Act (NEPA) and associated rules and guidelines. As administrator of the federal coal leasing program for surface and underground mining under the Mineral Leasing Act of 1920, as amended, the U.S. Bureau of Land Management (BLM) is considered the lead agency, under NEPA, responsible for the preparation of this EIS.

The BLM will use this impact analysis to make a leasing decision for federal coal reserves adjacent to the Buckskin Mine, an operating surface coal mine in the Powder River Basin (PRB) of northeast Wyoming. A federal coal lease does not authorize mining to occur, but is the first step in that process. The lease merely grants the lessee the exclusive right to pursue a mining permit for the coal tract subject to the terms of the lease, the mining permit itself, and all applicable state and federal laws. Permits to mine are issued by authorized federal and/or state agencies only after a lease has been secured and all appropriate agencies have reviewed and approved an extensive permit application. That application document provides information describing a wide range of baseline resources, as well as detailed mining, mitigation, and reclamation plans.

Other agencies will also use this EIS analysis to make decisions related to leasing and mining the federal coal in the proposed tract. The Office of Surface Mining Reclamation and Enforcement (OSM), all divisions of the Wyoming Department of Environmental Quality (WDEQ), the Wyoming Game and Fish Department (WGFD), and the Wyoming Department of Transportation are cooperating agencies on this EIS. The OSM is primarily responsible for administering federal programs that regulate surface coal mining operations. If a tract is leased, that agency will use this EIS to determine whether approval of the mining plan for the tract complies with the Mineral Leasing Act of 1920. The WDEQ has entered into a cooperative agreement with the Secretary of the Interior to regulate surface coal mining operations on federal and nonfederal lands in Wyoming. During the permitting process, the WDEQ incorporates input from the WGFD and the U.S. Fish and Wildlife Service (USFWS) to ensure that adequate monitoring, mitigation, and reclamation plans are in place for wildlife and fisheries resources and habitats. The Wyoming Department of Transportation may review the EIS if road construction or relocation projects are considered in the analyses.

1.1 Background

The Buckskin Mine is one of several mines currently operating in the PRB, where the coal seams are notably thick and the overburden is relatively thin throughout the region. The mine is

[1] Refer to page xiii for a list of abbreviations and acronyms used in this document.

operated by the Buckskin Mining Company, a directly held subsidiary of Kiewit Mining Properties, Inc. (Kiewit).

1.1.1 Buckskin Mine Application

On March 24, 2006, Kiewit filed an application to lease the federal coal included in a maintenance coal tract under the regulations at 43 Code of Federal Regulations (CFR) 3425 (Leasing on Application). A maintenance coal tract is tract of federal coal reserves that is adjacent to, and can be mined by, an existing active coal mine. The intent of the tract is to maintain production rather than to expand mine operations. The proposed tract is located northwest of and immediately adjacent to existing federal coal leases for the Buckskin Mine, approximately 12 miles north of Gillette, Campbell County, Wyoming (map 1-1).

The BLM, Wyoming State Office, Division of Minerals and Lands, has reviewed Kiewit's application for the proposed tract. That office determined that the lease application meets the regulatory requirements for an LBA. Map 1-1 shows the proposed tract, other currently pending LBA tracts, and the existing federal leases, including previously leased LBA tracts, in the PRB. The proposed tract was assigned BLM case file number WYW-172684. The 2006 application was subsequently modified in May and November of 2008. The November tract modification is evaluated in this EIS.

1.1.2 BLM Coal Leasing Process

The proposed tract is located in the Powder River Federal Coal Region. That area was decertified[2] for coal leasing in 1990 at the recommendation of the Powder River Regional Coal Team (PRRCT). The recommendation was made in response to the declining coal market and reduced interest in leasing sufficient quantities of coal to warrant a regional sale process during the previous eight years. The PRRCT is an independent advisory board of the BLM established to provide advice and guidance regarding the federal coal management program in the PRB. The board is comprised of various federal and state agencies, with voting members limited to the BLM and the state governments of Wyoming and Montana. In a region that is decertified, the BLM can consider leasing individual coal tracts by application to continue or extend the life of an existing mine under the rules of 43 CFR 3425. As part of the 1990 decertification decision, the PRRCT has continued to meet regularly to review the BLM's leasing activity in the PRB and to offer recommendations based on a regional perspective. That board reviewed the Hay Creek II application at a public meeting held on April 19, 2006, in Casper, Wyoming, and recommended that the BLM process the application.

The BLM leasing process does not authorize mining of federal coal reserves; applicants must first obtain permits to retrieve the coal from appropriate federal and/or state agencies. However, because mining is a logical consequence of issuing a maintenance lease to an existing operation, the impacts of mining the coal are considered in this EIS. All impacts identified in this analysis are addressed as part of the permitting process administered by authorized state and/or federal agencies to insure that they are adequately mitigated.

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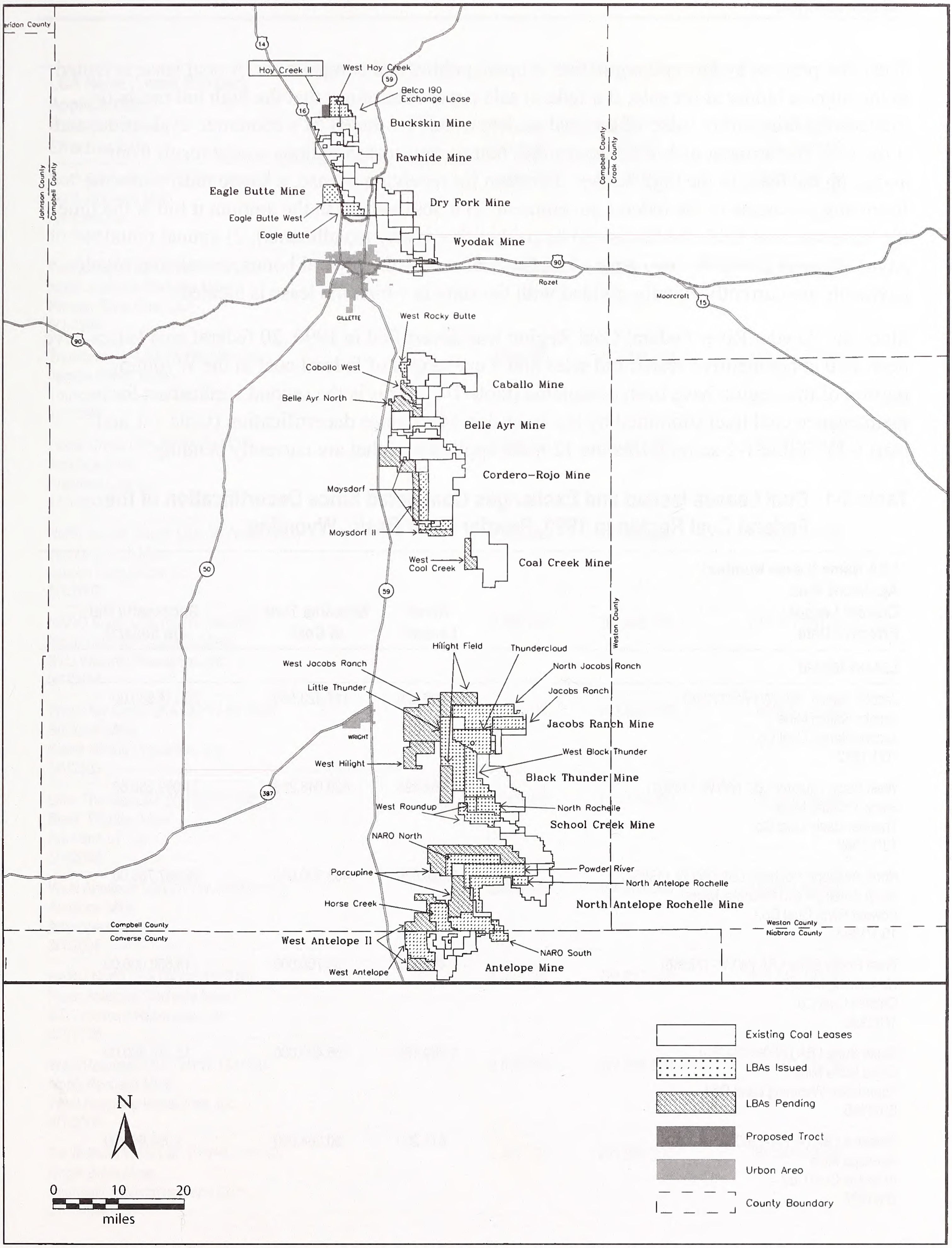
2 A detailed description of the decertification process is provided in the glossary in chapter 7.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 1-1
General Location Map with Federal Coal Leases and LBA Tracts

The LBA process by law and regulation is open, public, and competitive. A coal lease is issued to the highest bidder at the sale, if a federal sale panel determines that the high bid meets or exceeds the fair market value of the coal as determined by the BLM's economic evaluation, and if the U.S. Department of Justice determines that no antitrust violations would result from assigning the lease to the high bidder. In return for receiving a lease, a lessee must make the following payments to the federal government: 1) a bonus equal to the amount it bid at the time the lease sale was held (the bonus can be paid in five yearly installments); 2) annual rental payments; and 3) royalty payments when the coal is mined. Federal bonus, rental, and royalty payments are currently equally divided with the state in which the lease is located.

Since the Powder River Federal Coal Region was decertified in 1990, 20 federal coal leases have been sold at competitive sealed-bid sales and 3 exchanges of federal coal in the Wyoming portion of that region have been completed (table 1-1). This is the second application for a maintenance coal tract submitted by the Buckskin Mine since decertification (table 1-1 and map 1-1). Table 1-2 summarizes the 12 lease applications that are currently pending.

Table 1-1. Coal Leases Issued and Exchanges Completed Since Decertification of the Federal Coal Region in 1990, Powder River Basin, Wyoming

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid (in dollars)
LEASES ISSUED			
Jacobs Ranch LBA (WYW-117924) Jacobs Ranch Mine Jacobs Ranch Coal Co. 10/1/1992	1,708.620	147,423,560	20,114,930.00
West Black Thunder LBA (WYW-118907) Black Thunder Mine Thunder Basin Coal Co. 10/1/1992	3,492.495	429,048,216	71,909,282.69
North Antelope Rochelle LBA (WYW-119554) North Antelope and Rochelle Mines Powder River Coal Co.[2] 10/1/1992	3,064.040	403,500,000	86,987,765.00
West Rocky Butte LBA (WYW-122586) No Existing Mine[3] Caballo Coal Co. 1/1/1993	463.205	56,700,000	16,500,000.00
Eagle Butte LBA (WYW-124783) Eagle Butte Mine Foundation Wyoming Land Co.[4] 8/1/1995	1,059.180	166,400,000	18,470,400.00
Antelope LBA (WYW-128322) Antelope Mine Antelope Coal Co.[5] 2/1/1997	617.200	60,364,000	9,054,600.00

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid (in dollars)
North Rochelle LBA (WYW-127221) North Rochelle Mine Ark Land Co. 1/1/1998	1,481.930	157,610,000	30,576,340.00
Powder River LBA (WYW-136142) North Antelope Rochelle Mine Powder River Coal Co.[2] 9/1/1998	4,224.225	532,000,000	109,596,500.00
Thundercloud LBA (WYW-136458) Jacobs Ranch Mine Thunder Basin Coal Co., LLC 1/1/1999	3,545.503	412,000,000	158,000,008.50
Horse Creek LBA (WYW-141435) Antelope Mine Antelope Coal Co.[5] 12/1/2000	2,818.695	275,577,000	91,220,120.70
North Jacobs Ranch LBA (WYW-146744) Jacobs Ranch Mine Jacobs Ranch Coal Co. 5/1/2002	4,982.240	537,542,000	379,504,652.00
NARO South LBA (WYW-154001) North Antelope Rochelle Mine BTU Western Resources, Inc. 9/1/2004	2,956.725	297,469,000	274,117,684.00
West Hay Creek LBA (WYW-151634) Buckskin Mine Kiewit Mining Properties, Inc. 1/1/2005	921.158	142,698,000	42,809,400.00
Little Thunder LBA (WYW-150318) Black Thunder Mine Ark Land LT Co. 3/1/2005	5,083.500	718,719,000	610,999,949.80
West Antelope LBA (WYW-151643) Antelope Mine Antelope Coal Co.[5] 3/1/2005	2,809.130	194,961,000	146,311,000.00
NARO North LBA (WYW-150210) North Antelope Rochelle Mine BTU Western Resources, Inc. 3/1/2005	2,369.380	324,627,000	299,143,785.00
West Roundup LBA (WYW-151134) North Rochelle Mine West Roundup Resources, Inc. 5/1/2005	2,812.510	327,186,000	317,697,610.00
Eagle Butte West LBA (WYW-155132) Eagle Butte Mine Foundation Wyoming Land Co.[4] 2/20/2008[6]	1,427.770	255,000,000	180,540,000.00

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid (in dollars)
South Maysdorf (Mt. Logan) (WYW-174407)[3] Cordero Rojo Cordero Mining Co. 4/22/2008	2,900.240	288,081,000	250,800,000.00
North Maysdorf (Mt. Logan) (WYW-154432)[7] Cordero Rojo Cordero Mining Co. 1/29/2009	445.890	54,657,000	48,098,424.00
Total Leases Issued	**49,183.640**	**5,781,562,776**	**3,162,452,451.69**
Exchanges Completed			
EOG (Belco) I-90 Lease Exchange (WYW-150152) EOG Resources (formerly Belco)[8] I-90 Lease Exchanged for New Lease 4/1/2000	599.170	106,000,000	Lease rights to Belco I-90 Lease (WYW0322794)
Pittsburgh & Midway Coal Exchange (WYW-148816)Pittsburgh & Midway Coal Mining Co. Private Land Exchanged for Federal Coal 1/27/2005	2,045.530	84,200,000	6,065.77 acres of land and some minerals in Lincoln, Carbon, and Sheridan Counties, Wyoming
Powder River Coal Company Gold Mine Draw (WYW-003397 and WYW-83394)Powder River Coal Co.[2] AVF Coal Lease 6/30/2006	623.000	47,700,000	Lease rights to 921.6 acres of leased federal coal underlying an AVF exchanged for adjacent bypass coal
Total Exchanges Completed	**3,267.70**	**237,900,000**	

LBA = lease by application AVF = Alluvial Valley Floor

1 Information from sale notice.

2 Name changed to Powder River Coal, LLC, in August 2006.

3 The West Rocky Butte LBA was originally leased to Northwestern Resources Company. The lease has been assigned and incorporated into the Caballo Mine.

4 Ownership of the Eagle Butte Mine and Belle Ayr Mine changed from Foundation Coal West, Inc., to Alpha Coal West, Inc., as of July 31, 2009. Notification of ownership submitted to the BLM in August 2009.

5 Notification of name change to Antelope Coal, LLC, submitted to the WDEQ in August 2008.

6 Sale date.

7 The applied-for LBA (original and modified) was classified under one serial number (WYW-154432) until later determination had been made to split into North and South.

8 The EOG Resources Belco Exchange lease is now owned by the Buckskin Mine.

Source: BLM Lease by Application Data Sheets (BLM 2009b)

Table 1-2. Pending Coal Leases by Application, Powder River Basin, Wyoming

LBA Name (Lease Number) Applicant Mine	Application Date	Acres as Applied for	Estimated Coal[1] as Applied for (million tons)	Status
Belle Ayr North (WYW-161248) Belle Ayr Mine	7/6/2004	1,578.74	191.90	Draft EIS available 10/24/2008 Public hearing 11/19/2008 Final EIS in preparation
West Antelope II (WYW-163340) Antelope Mine	4/6/2005	4,108.60	429.70	Final EIS available 12/19/2008 Record of decision in preparation
North Hilight Field (WYW-164812) Black Thunder Mine	10/7/2005	2,613.50	263.40	Draft EIS available June 2009 Public hearing 7/29/2009 Final EIS in preparation
South Hilight Field (WYW-174596) Black Thunder Mine	10/7/2005	1,976.69	213.60	Draft EIS available June 2009 Public hearing 7/29/2009 Final EIS in preparation
West Hilight Field (WYW-172388) Black Thunder Mine	1/17/2006	2,370.52	377.90	Draft EIS available June 2009 Public hearing 7/29/2009 Final EIS in preparation
West Coal Creek (WYW- 172585) Coal Creek Mine	2/10/2006	1,151.26	57.00	Draft EIS available 10/24/2008 Public hearing 11/19/2008 Final EIS in preparation
Caballo West (WYW-172657) Caballo Mine	3/15/2006	777.49	81.80	Draft EIS available 10/24/2008 Public hearing 11/19/2008 Final EIS in preparation
West Jacobs Ranch (WYW-172685) Jacobs Ranch Mine	3/24/2006	5,944.37	669.60	Draft EIS available June 2009 Public hearing 7//29/2009 Final EIS in preparation
Hay Creek II (WYW-172684) Buckskin Mine	3/24/2006; Modified 5/19/2008 and 11/28/2008	419.04	77.2	Draft EIS in preparation Public hearing 12/03/2009
Maysdorf II (WYW-173360) Cordero Rojo Mine	9/1/2006	4,653.84	474.50	Draft EIS available 10/24/2008 Public hearing 11/19/2008 Final EIS in preparation
North Porcupine (WYW-173408) North Antelope Rochelle Mine	9/27/2006; Modified 10/12/2007	5,795.78	601.20	Draft EIS available June 2009 Public hearing 7/29/2009 Final EIS in preparation
South Porcupine (WYW-176095) North Antelope Rochelle Mine	9/29/2006; Modified 10/12/2007	3,185.96	309.70	Draft EIS available June 2009 Public hearing 7/29/2009 Final EIS in preparation
Total LBAs Pending		**34,575.79**	**3,747.50**	

LBA = lease by application; EIS = environmental Impact Statement

[1] Estimated tons of in-place or mineable coal, as reported in the lease application, or of recoverable coal as reported by the applicant, depending on the mine.

Source: BLM Lease by Application Data Sheets (BLM 2009b).

1.1.3 Existing Buckskin Mine

1.1.3.1 General Description

The WDEQ/Land Quality Division (LQD) approved the current Buckskin Mine permit (Permit 500 Term T7) on May 22, 2006. The existing Buckskin Mine permit area is 8,011.5 acres and encompasses previously permitted federal and state coal leases (5,877.9 and 659.5 acres, respectively) Map 1-2 shows the permit area and existing leases. Approximately 6,727.8 acres will be disturbed by activities related to extracting these reserves. The total disturbance area exceeds the leased area because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to ensure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

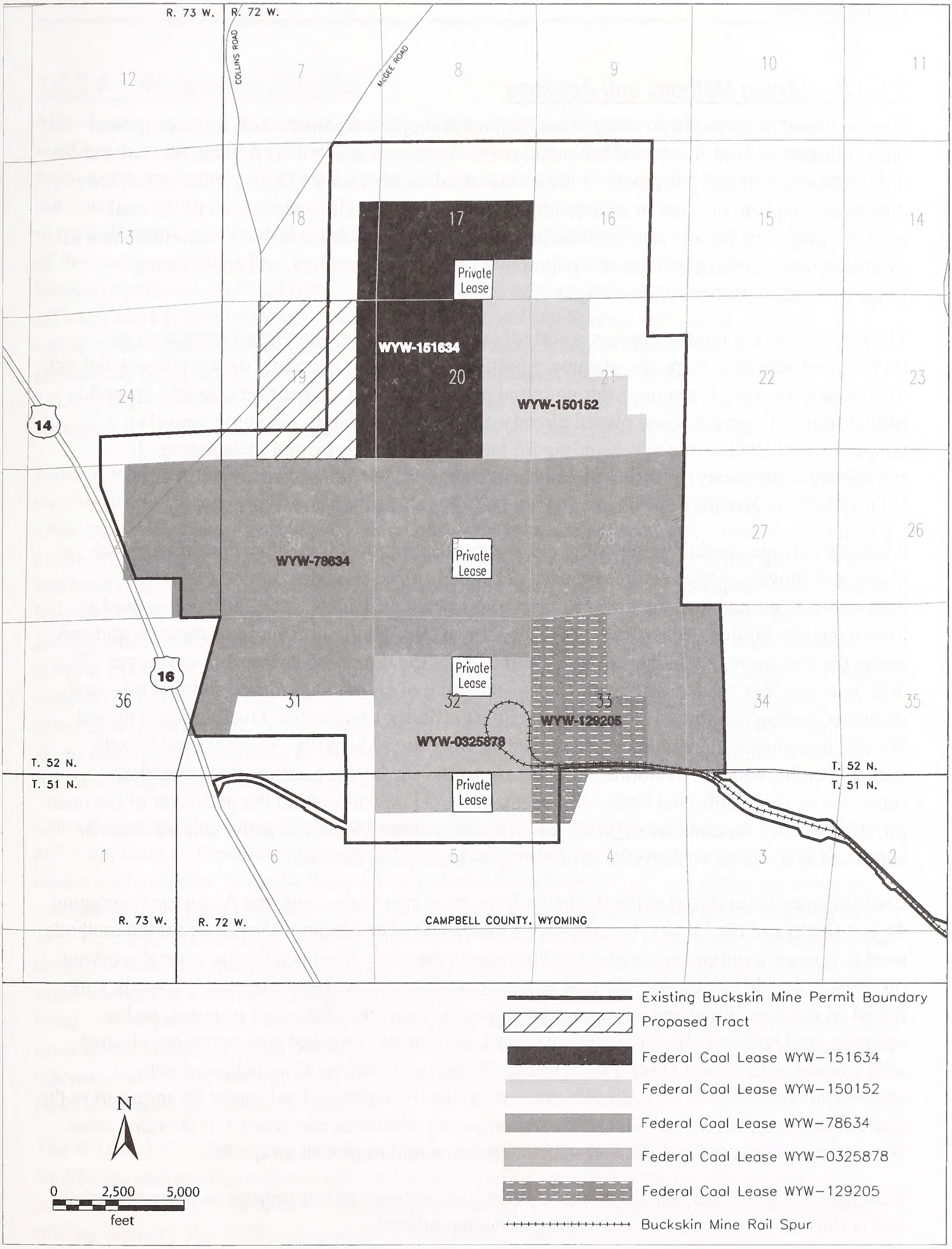
As of December 2008, Kiewit estimates the in-place coal reserves in the existing Buckskin Mine to be 460.9 million tons, of which 344.3 million tons are recoverable. Through December 2008, the mine has produced a total of 339.8 million tons of coal. Annual production averaged 20.6 million tons over the previous six years, with a maximum of 25.3 million tons in any single year (Buckskin Mining Company 2002 through 2007). Buckskin Mine's current air quality permit, as approved by WDEQ/Air Quality Division (AQD), allows mining of as much as 42 million tons of coal per year. Kiewit estimates that the average annual production at the mine after January 1, 2009, will be 25 million tons per year. If production continues at rate, Kiewit estimates that the post-2008 recoverable reserves at the Buckskin Mine would be depleted within approximately 14 years.

The surface of the existing permit area is entirely private and owned by Kiewit. Existing land uses on the proposed tract include rangeland livestock grazing, wildlife habitat, pastureland, dryland cropland, and coal bed natural gas (CBNG) development. All oil and gas production facilities located in the proposed tract are privately owned. Surface ownership is discussed further in section 1.5, and ownership of oil and gas estates is discussed in section 3.11.

1.1.3.2 Mine Facilities and Employees

The Buckskin Mine uses one coal crushing facility, which is located at the coal preparation plant. Five active coal storage silos are currently in use at the mine. These facilities provide the capacity to produce, store, and distribute coal at the permitted tonnage. All coal transfer location points and crushing operations are controlled by baghouse-type dust collectors, dry fog systems, or passive enclosure control systems. The truck dumping operation uses a stilling shed to control fugitive dust. While sufficient production and storage capacity currently exist at the Buckskin Mine, future modifications to those facilities may be constructed to improve operating efficiency and air quality protection.

The Buckskin Mine work force currently totals 338 employees. Buckskin Mine is currently seeking 10 additional employees to meet staffing need for current mining operations.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 1-2

Buckskin Mine's Federal Coal Leases and Proposed Tract

1.1.3.3 Mining Methods and Activities

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood- and sediment-control measures are built as needed, and any public utility lines and oil and gas pipelines are be relocated, as necessary. During mining, surface disturbance typically occurs in an area larger than the lease itself to recover all of the coal reserves within the lease. Surface disturbance outside the coal lease is due to activities such as overstripping, matching reclaimed topography to premining contours, and constructing flood- and sediment-control structures.

The first step of the mining process is soil salvage with suitable heavy equipment such as rubber-tired scrapers. Topsoil—the upper portion of a soil that is usually darkly colored and rich in organic material—is removed during initial pit development. Whenever possible, topsoil is hauled from salvage areas and placed directly on recontoured lands, but some topsoil is temporarily stockpiled due to scheduling for later use in pit closure and reclamation. If stockpiling is necessary, topsoil is seeded with a temporary plant mix approved by the WDEQ/LQD to provide vegetative cover and prevent wind and water erosion.

After soil salvage operations are complete, overburden removal is conducted primarily with trucks and shovels. Other equipment used during this phase includes dozers, scrapers, excavators, front-end loaders, graders, and water trucks. When necessary, blasting is used to loosen the overburden. Blast holes are drilled down through the overburden—the rock and soil above the coal seam, excluding topsoil—to the top of the upper-most mineable coal seam. The drill holes are then loaded with explosives—a mixture of ammonium nitrate and fuel oil—and detonated to fragment the overburden to facilitate efficient excavation. Overburden is placed directly into already mined pits or stockpiled for later use as backfill. Sheer highwalls with vertical heights equal to overburden and interburden—the layer of sedimentary rock that separates two mineable coal beds—if present, plus coal thickness form the perimeter of the open pit. If necessary, streams are diverted into temporary channels around active mining areas or contained in temporary reservoirs to prevent pits from being flooded.

Coal is currently produced at the Buckskin Mine from two coal seams, the Anderson (averaging 45 feet thick) and the Canyon (averaging 70 feet thick). The blasting, shovel, and truck methods used to remove overburden are also used to recover the coal. Coal is mined at several working pit faces to enable blending of the coal to meet customer quality requirements, to comply with the BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Exposed coal seams are cleaned with a dozer, drilled, and blasted to facilitate efficient excavation. Coal is loaded with electric-powered shovels or hydraulic excavators into off-highway haul trucks for transport to the coal preparation plant. Coal haul roads are temporary structures constructed in the mine areas. Haul roads are watered and sprayed with dust suppressant to protect air quality.

Coal from the Buckskin Mine is sold to a variety of domestic power utilities in an open market and is shipped by commercial rail to the purchasing utilities.

1.1.3.4 Reclamation Activities

Mined-out areas must be restored to approximate original contour or other topographic configuration approved by the WDEQ/LQD. A direct permanent impact of coal mining is topographic moderation (section 3.2). Mined-out areas must be restored to recreate the original contours or other topographic configurations to the extent possible. The postmining topography is typically similar to the premining topography, but is gentler and more uniform. The removal of the coal is partially offset by the swelling that occurs when overburden and interburden are blasted, excavated, and backfilled. The approximate original drainage pattern of all streams in affected areas is also restored (section 3.5). In-channel stockponds and playas (shallow topographic depressions) are replaced to provide livestock and wildlife watering sources. All postmining topography, including reconstructed drainages, must be approved by the WDEQ/LQD. After mining, the land is reclaimed to support the premining uses described in section 1.1.3.1. Oil and gas wells, pipelines, and utility easements are reestablished as required.

Most overburden is placed directly into areas where coal has already been removed. Replaced overburden is graded to reflect the original land surface contour, as required by WDEQ and OSM rules. Elevations consistent with an approved postmining topography plan are established as quickly as possible to construct a stable landscape and restore drainage. Once the overburden has been replaced and recontoured, it is sampled and analyzed to verify its suitability as subsoil. Material found to be unsuitable for use in reestablishing vegetation or that could affect groundwater quality due to high concentrations of certain parameters, such as selenium or adverse pH levels, is either removed and treated or adequately covered with suitable overburden material prior to depositing topsoil. Under certain conditions, the postmining topography is not immediately achievable. This occurs when an excess material requires temporary stockpiling, when insufficient material is available from current overburden removal operations, or when future mining could redisturb an area already mined.

Once the postmining topography has been completed, the regraded backfill is scored to relieve soil compaction. Topsoil is redistributed using rubber-tired scrapers or haul trucks, dozers, and blades and a seedbed is established. Once a seedbed has been formed, the reclaimed areas are revegetated using native grasses, forbs, and shrubs that are consistent with the postmining land use. Permanent reclamation must be seeded with WDEQ-approved seed mixes. Reseeded areas are monitored for a minimum of 10 years to evaluate the success of vegetation growth and the establishment of a variety of plant species prior to the final (Phase III) release of the reclamation bond. Other parameters, such as successful use of reclaimed areas by livestock and wildlife, also must be demonstrated before Phase III bond release is achieved. All reclamation goes through rigorous monitoring and a process of success verifications dictated by the WDEQ/LQD before bond is released on reclaimed lands.

The WDEQ/LQD Coal Rules and Regulations (Chapter 4, Section 2(b)(i)) require that rough backfilling and grading follow coal removal as closely as possible based on the mining conditions (WDEQ/LQD 2005). According to a recent OSM evaluation of the Wyoming coal mining industry, the 2007 reclamation-to-disturbance ratio was approximately 80%

(12,258 total acres reclaimed versus 15,321 total acres disturbed) (OSM 2008). The remaining 20% of disturbance consists of long-term facilities and infrastructure such as coal storage silos and processing plants, roads, and rail lines. Those lands will be reclaimed when mine operations cease and all infrastructure has been removed from the site. The lengthy period required for final bond release means that the total acres listed as reclaimed for Wyoming coal mines likely includes a combination of areas that have been completely reclaimed and others that are in various stages of reclamation.

The WDEQ/LQD also requires that mining companies post a reclamation bond on all acres disturbed by their activities within their own permit boundary. The bond must be large enough to cover the cost of completing reclamation, should the company default on its obligations. One major condition for receiving Phase III bond release is to document that the reclaimed area has achieved the vegetative cover and production and plant species diversity equal to a predetermined native comparison area, the reference area. For example, if shrubs were present during baseline vegetative inventories, the reclaimed area must also have a shrub density of one plant per square meter over 20% of the area. The Buckskin Mine has an annual program of interim vegetation monitoring to ensure that reclamation efforts are proceeding in a positive manner to achieve final bond release.

Land Status categories are calculated on an annual basis and reported in the Annual Report to the WDEQ/LQD. The parameters of each phase of bond release are described in detail in WDEQ Guideline 20, available on the agency's website at http://deq.state.wy.us/lqd/guidelines.

Table 1-3 provides a general summary of reclaimed acreages at the Buckskin Mine and their respective stages of bond release. As of December 31, 2008, Buckskin had disturbed approximately 3,815 acres over the life of the mine, of which about 1,035 (273%) are associated with long-term mining facilities that will not be reclaimed until all mining operations have ceased. Approximately 1,256 (33%) of the 3,815 disturbed acres have been permanently reclaimed. Permanently reclaimed areas refer to all affected lands which have been backfilled, graded, re-topsoiled, and permanently seeded according to approved practices specified in the WDEQ/LQD approved Reclamation Plan for the mine. Permanently reclaimed lands must then meet various benchmarks associated with vegetative conditions as well as wildlife and livestock grazing before they achieve Phase III bond release.

Reclaimed lands often fall into multiple bond release categories due to two primary factors: the overlap between activities in a given reclamation area; and the time-lag between reclamation actions, such as reseeding with permanent seed mixes, and responses to those actions (e.g., vegetation growth and production) necessary to receive Phase III bond release. Consequently, the reclaimed acreages shown in table 1-3 fall into multiple phases of bond release, and therefore do not total 1,256.

Table 1-3. Summary of Land Status Acreage at the Buckskin Mine through December 2008

Land Status	Acres	Approximate Percentages
Undisturbed areas	4,196	52% of 8,011 total acres in permit area
Disturbed areas	3,815	48% of 8,011 total acres in permit area
Long-term facilities[1]	1,035	27% of disturbance
Active mining and reclamation	1,525	40% of disturbance
Reclaimed land[2]	1,256	33% of disturbance
Phase I[3] bond release	1,212	96% of reclamation
Phase II[4] bond release	250	7% of reclamation
Phase III[5] final bond release	250	7% of reclamation

[1] Long-term facilities includes stockpiles, hydrologic control structures, mine buildings, coal-loading facilities, main access road, electrical substations, vehicle parking areas, railroad loop, environmental monitoring areas, and other similar structures and features that will not be reclaimed until all mining operations have ceased.

[2] Reclaimed land refers to previously disturbed areas that have been planted with permanent seed mixes.

[3] Phase I refers to areas where backfilling, re-grading, topsoil replacement, contouring, and drainage control have been completed in a bonded area in accordance with the mine's approved reclamation plan.

[4] Phase II refers to areas that have achieved Phase I release, and also have vegetation species composition commensurate with that of the seed mix(es) and species composition required by the WDEQ/LQD approved Reclamation Plan. Mines often go directly from Phase I to Phase III due to the overlap between Phase II and Phase III.

[5] Phase III refers to lands that have been restored to the approved postmine land use and with successful restoration of wildlife habitat; where revegetation performance standards, shrub establishment goals, and tree replacement requirements have been met; the postmining groundwater, and surface water quality and quantity support land uses; any approved postmining road types and corridors on evaluated acreage are in place and functional; and any temporary structures present on lands being evaluated have been removed. Acreage shown includes acres added in 2009.

To achieve Phase III Bond Release, reclaimed lands must also support the postmining land use (i.e., grazing and wildlife), as determined through grazing trials and by monitoring wildlife use during the reclamation period. At the Buckskin Mine, reclamation is typically grazed by fencing multiple fields together to create a larger pasture; multiple pastures are sometimes also combined. The mine first began grazing cattle in 1998 and continued grazing efforts in 9 of the 10 subsequent years (1999 through 2008). The number of cattle grazed during a given session ranged from 107 to 200 during that period, with an average grazing time of 34 days (range 12 to 63 days) in a given pasture. Grazing cattle consisted primarily of cow-calf pairs, with a few bulls included in some years. Annual wildlife monitoring efforts at the Buckskin Mine are described in section 3.10, and have included reclaimed lands as they became established. The WGFD reviews the annual wildlife report each year to ensure that proper survey protocols have been followed and to monitor impacts to wildlife populations in the vicinity of the surface coal mines in the PRB. That agency has not identified any deficiencies in the Buckskin Mine annual wildlife reports.

1.1.3.5 Hazardous and Solid Waste

Wastes produced by current mining activities at Buckskin are handled according to the procedures described in WDEQ/LQD Mine Permit 500 Term T7, approved May 22, 2006. Solid waste produced at the existing Buckskin Mine consists of floor sweepings, shop rags, lubricant

containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. A portion of the solid wastes produced at the mine is disposed of within the Buckskin Mine permit boundary in accordance with WDEQ-approved solid waste disposal plans. Solid waste is also disposed of at the Campbell County landfill. Sewage is handled by WDEQ-permitted sewage systems present on the existing mine facilities.

Maintenance and lubrication of most of the equipment takes place at existing shop facilities at the Buckskin Mine. Major lubrication, oil changes, and other maintenance operations for most equipment are performed inside the service building bays. Used oil and grease are contained and deposited in storage tanks in that building. All collected used oils and grease are then beneficially recycled off site or used for energy recovery.

The Buckskin Mine has reviewed the U.S. Environmental Protection Agency's (EPA's) "Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Re-authorization Act (SARA) of 1986 (as amended)" and EPA's "List of Extremely Hazardous Substances," as defined in 40 CFR 355, (as amended) for hazardous substances used at the mine. Hazardous substances are designated under Section 102 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended; extremely hazardous substances are listed in Section 302 of the Emergency Planning and Community Right to Know Act. The mine maintains files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances that are or would be used during the course of mining.

The Buckskin Mine is responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials that occurs as a result of mining activities are in accordance with all applicable existing or future federal, state, and local government rules, regulations, and guidelines. All mining activities involving the production, use, and/or disposal of hazardous or extremely hazardous materials are and would continue to be conducted to minimize potential environmental impacts.

The mine must also comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40 CFR 117, is reported as required by CERCLA, as amended. The materials for which such notification must be given are listed in Section 302 of the Emergency Planning and Community Right to Know Act and Section 102 of CERCLA, as described above. If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice is given to the WDEQ and all other appropriate federal and state agencies.

Each mining company is expected to prepare and implement several plans and policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies include:

- spill prevention control and countermeasure plans;
- spill response plans;

- stormwater pollution prevention plans;
- inventories of hazardous chemical categories pursuant to Section 313 of SARA, as amended; and
- emergency response plans.

In addition, all mining operations must comply with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Mine Safety and Health Act, and the CAA. In addition, mining operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

Compliance with these regulations is the current practice at the Buckskin Mine. Kiewit's acquisition of the proposed tract or alternative tract configuration would not change these practices, nor the type and quantity of any wastes generated and disposed of by the mine.

1.2 Purpose and Need for Action

The purpose of the Proposed Action is to provide a technically and economically feasible method for the Buckskin Mine to pass through a geologic irregularity, known as the Sand Channel Area, to reach low-sulfur compliance coal in the existing Spring Draw lease (WYW-78634). The Proposed Action would not expand operations at the Buckskin Mine, but would maintain current levels of production. The Proposed Action also would extend the life of the mine by approximately two years[3]. The permitting process that follows the lease sale takes several years to complete. Kiewit is applying for the federal coal reserves in the proposed tract now, so that it can secure coal resources to market, enter into new contracts, and complete the permitting processes in time to mine the new lease in a logical progression.

More broadly, the Proposed Action responds to the continued demand for coal in the U.S., primarily for the purpose of generating electricity. According to the Energy Information Administration (2008a), the U.S. has the world's largest known coal reserves. Demand for this coal is driven by the electric power sector, which accounts for about 92% of coal consumption (Energy Information Administration 2008a, 2008b). Approximately half of the electricity currently generated in the U.S. comes from coal (U.S. Department of Energy 2009). Wyoming coal is used to generate electricity in 37 other states (Wyoming Mining Association 2009).

The Energy Policy Act of 2005 directs federal agencies to undertake efforts to ensure energy efficiency and the production of secure, affordable, and reliable domestic energy. A primary goal of the National Energy Policy is to increase domestic energy supplies from diverse sources such as oil, gas, coal, hydropower, wind, and nuclear power in a long-term effort to reduce U.S. dependence on foreign energy sources. The BLM recognizes that the continued extraction of coal is essential to meet the nation's future energy needs and goals. Consequently, private

[3] Assuming that coal production would continue at the most recent (2008) annual coal production rate of 25 million tons per year.

development of federal coal reserves is integral to the BLM's coal leasing program under the authority of the Mineral Leasing Act of 1920, as well as the Federal Land Policy Management Act (FLPMA) and the Federal Coal Leasing Amendments Act of 1976. Under FLPMA, the BLM is mandated to manage public lands for multiple-use so that the lands are utilized in the combination that will best meet the present and future needs of the American people. FLPMA authorizes the BLM to manage the use, occupancy, and development of public lands through leases and permits (43 CFR 2710).

Management of federal coal resources—leasing, mining, and selling—in the PRB contributes to a reliable supply of low-sulfur compliance coal for electric power generation in the U.S. The low-sulfur compliance coal from the PRB enables coal-fired power plants to meet current Clean Air Act (CAA) requirements and increasing demand without potentially significant increases in power costs while new technologies are developed to improve efficiency and reduce emissions. Management of federal coal resources in the PRB also generates revenue—in the form of bonus, annual rental, and royalty payments—that is used to fund numerous infrastructure and social projects in Wyoming.

1.3 Regulatory Authority and Responsibility

The authorities and responsibilities of the BLM and other concerned regulatory agencies are described in this section, including a detailed description of the permitting process that follows BLM leasing of federal coal reserves.

The Hay Creek II application was submitted and will be processed and evaluated under the following federal authorities:

- Mineral Leasing Act of 1920, as amended;
- Multiple-Use Sustained Yield Act of 1960;
- NEPA;
- Federal Coal Leasing Amendments Act of 1976;
- FLPMA; and
- Surface Mining Control and Reclamation Act of 1977 (SMCRA).

As described previously, the BLM is the lead agency responsible for leasing federal coal reserves under the Mineral Leasing Act of 1920, as amended by the Federal Coal Leasing Amendments Act in 1976. The BLM is also responsible for preparing this EIS to evaluate the potential environmental impacts of issuing a coal lease and the subsequent mining of that coal, which would be the logical outcome of any leasing action. As part of the EIS and leasing processes, the BLM also has a responsibility to consult with and obtain the comments and assistance of cooperating agencies, such as the OSM and WDEQ, as well as other state and federal agencies that have jurisdiction by law or special expertise with respect to potential environmental impacts.

After a federal coal lease is issued, the SMCRA gives OSM primary responsibility to administer programs that regulate surface coal mining operations, as well as the surface effects of underground coal mining operations. Pursuant to Section 503 of the SMCRA, the WDEQ developed a permanent program authorizing that agency to regulate surface coal mining operations and surface effects of underground mining on nonfederal lands within Wyoming. In November 1980, the Secretary of the Interior approved that program. In January 1987, pursuant to Section 523(c) of the SMCRA, the WDEQ entered into another cooperative agreement with the Secretary of the Interior authorizing that agency to regulate surface coal mining operations and surface effects of underground mining on federal lands within the state; no federal surface is included in any of the analysis areas for this EIS.

The net result of those actions was to give the WDEQ the authority to serve as an agent of the OSM to issue permits to mine coal in Wyoming. Before a newly leased area can be disturbed, the lessee must submit an extensive permit application package to the WDEQ/LQD to amend the current permit document to include any proposed coal mining and reclamation operations associated with the newly leased coal reserves. That agency acts as the conduit for distributing the package to other divisions within the WDEQ, as well as other state and federal agencies with a vested interest or cooperator status in the permitting process and future impacts of mining.

The WDEQ carefully reviews the permit application package to ensure that it complies with the permitting requirements, and that the coal mining operation will meet the performance standards of the approved Wyoming program. The BLM and other state and federal agencies also review the application package to ensure that it complies with the terms of the coal lease, applicable state requirements, the Mineral Leasing Act, NEPA, and other state and federal laws and their attendant regulations.

If the permit application package complies, the WDEQ/LQD issues a permit to the applicant to conduct coal mining operations. The final permit application document and the actual permit are then submitted to OSM, which recommends approval, approval with conditions, or disapproval of the Mineral Leasing Act mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the mining plan can be approved, the BLM must approve the Resource Recovery Protection Plan for mining the tract.

If a proposed LBA tract is leased to an existing mine, the lessee is required to revise its coal mining permit before the coal can be extracted, following the processes outlined above. As a part of that process, a detailed new plan must be developed showing how the newly leased lands would be mined, mitigated, and/or reclaimed. Surface disturbance associated with mining would actually occur in an area larger than the newly leased tract to allow for activities such as overstripping, matching reclaimed topography to premining contours, constructing flood- and sediment-control facilities, and numerous other related activities. Specific impacts on various resources that would occur during the mining and reclamation of an LBA tract would be addressed in the mining and reclamation plan, including specific, detailed measures to mitigate anticipated impacts. As noted, the mining, mitigation, and reclamation plans must all be

approved by appropriate state and federal agencies before mining can proceed in newly leased coal tracts.

The WDEQ/LQD enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies. The OSM retains oversight responsibility for this enforcement. Appendix A presents other federal and state permitting requirements that must be satisfied to mine the proposed tract.

1.4 Relationship to BLM Policies, Plans, and Programs

In addition to the federal acts listed under section 1.3, guidance and regulations for managing and administering public lands—including the federal coal reserves in the Kiewit application—are set forth in 40 CFR 1500 (Protection of Environment), 43 CFR 1601 (Planning, Programming, Budgeting), and 43 CFR 3400 (Coal Management).

Specific guidance for processing applications follows BLM Manual 3420, Competitive Coal Leasing (BLM 1989) and the 1991 *Powder River Regional Coal Team Operational Guidelines for Coal Lease-By-Applications* (BLM 1991). The *National Environmental Policy Act Handbook* (BLM 2008b) has been followed in developing this EIS.

1.5 Conformance with Existing Land Use Plans

The Federal Coal Leasing Amendments Act of 1976 requires that lands considered for leasing be included in a comprehensive land use plan and that leasing decisions be compatible with that plan. The BLM *Approved Resource Management Plan (RMP) for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a), governs and addresses the leasing of federal coal in Campbell County. The 2001 document is an update of the previous *Buffalo Resource Area RMP* (BLM 1985), and will be referred to as the 2001 RMP update throughout this EIS.

The major land use planning decision that the BLM must make concerning federal coal resources is a determination of which coal reserves are acceptable for further consideration for leasing. The BLM uses four screening procedures to identify these coal reserves. These screening procedures require the BLM to:

- estimate the development potential of the federal coal reserves;
- apply the unsuitability criteria listed in the regulations at 43 CFR 3461;
- make decisions related to multiple land uses that eliminate federal coal deposits from consideration for leasing to protect other resource values; and
- consult with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5(gg)(1) and (2).

Only those federal coal reserves that pass these screens receive further consideration for leasing. The BLM has applied these coal screens to federal coal reserves in Campbell County several times, beginning in the early 1980s. In 1993, the BLM began the most recent process of reapplying these screens in Campbell, Converse, and Sheridan counties in eastern Wyoming. This screening analysis process, which includes the portion of Campbell County where the proposed tract is located, was adopted in the 2001 RMP update, and the results were included as appendix D of that update. That document can be viewed in the 2001 documents section on the Wyoming BLM website at: http://www.blm.gov/rmp/WY/application/index.cfm/rmpid=101.

Under the first coal screening procedure, a coal tract must be located within an area that has been determined to have coal development potential in order to be acceptable for further consideration for leasing (43 CFR 3420.1-4(e)(1)). In the coal screening analyses published in its 2001 RMP update, the BLM identified the proposed tract as being in an area with this coal development potential.

The second screening procedure requires the application of coal mining unsuitability criteria listed in the federal coal management regulations (43 CFR 3461). The coal mining unsuitability criteria were applied to lands in the PRB with high to moderate coal development potential, including the proposed tract and surrounding lands, during the coal screening conducted for the 2001 RMP update. Appendix B of this EIS summarizes the unsuitability criteria, describes the general findings for the 2001 RMP update, and presents a validation of these findings for the proposed tract, as well as adjacent unleased federal coal reserves. Chapter 2 provides detailed descriptions of the proposed tract and those adjacent coal reserves, as well as the result of the review of the unsuitability criteria specific to both areas. As indicated in appendix B, several criteria will be further evaluated during the leasing process.

The third coal screening procedure consists of a conflict analysis for multiple-use activities on the lands associated with the coal reserves that are under consideration for leasing. In accordance with 43 CFR 3420.1-4(e)(3), that analysis must be completed to identify and "eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria." The 2001 RMP update addresses two types of multiple land-use conflicts: municipal/residential conflicts and multiple mineral development (coal versus oil and gas) conflicts. The proposed tract does not lie within or near an identified buffer zone surrounding an existing community; therefore, no federal coal reserves within that tract configuration have been eliminated from further consideration for leasing due to municipal/residential conflicts.

The 2001 RMP update includes two decisions related to multiple mineral development conflicts in Campbell, Converse, and Sheridan counties. With respect to oil and gas leasing in coal mining areas, it determined that oil and gas tracts that would interfere with coal mining operations would not be offered for lease but that, where possible, oil and gas leases would be issued with specific conditions to prevent a development conflict with coal mining operations. With respect to coal leasing in oil and gas fields, the 2001 RMP update states that coal leasing in producing oil and gas fields would be deferred unless or until coal development would not

interfere with the economic recovery of the oil and gas resources, as determined on a case-by-case basis.

The BLM's evaluation of the potential for conflict with the development of oil and gas resources within the proposed tract is discussed in section 3.3. The BLM's policy and guidance on conflicts between surface coal mining and CBNG development is to optimize the recovery of both resources and to ensure that the public receives a reasonable return, as explained in BLM Instruction Memorandum No. 2006-153 (BLM 2006a).

The fourth coal screening procedure requires consultation with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5(gg)(1) and (2)[4]. Surface owner consultation was conducted as part of the coal screening analyses published in the 2001 RMP update. Private surface owners in the Gillette coal development potential area (including Campbell County and northern Converse County) were provided the opportunity to express their preference for or against surface mining of federal coal under their private surface estate during that screening. At that time, no attempt was made to distinguish qualified surface owners. Appendix D of the 2001 RMP update states that "no area should be dropped from further consideration for leasing as a result of responses received from surface owners." Therefore, no federal coal reserves within the proposed tract have been eliminated from further consideration for leasing due to qualified surface owner conflicts at this time.

Private surface owners who are found to be qualified must consent to leasing before the BLM can offer the underlying federal coal reserves for lease. The BLM will review the current surface ownership in the final tract configuration. Prior to offering any tract for lease, consent to leasing must be provided for any lands held by any qualified surface owner.

In summary, the proposed tract has been subjected to the four coal planning screens and determined acceptable for further consideration for leasing. Thus, a decision to lease the federal coal reserves in this application would be in conformance with the 2001 RMP update.

1.6 Consultation and Coordination

1.6.1 Initial Involvement

The BLM received the Hay Creek II coal lease application on March 24, 2006. The BLM, Wyoming State Office, Division of Minerals and Lands, initially reviewed the application and ruled that the application and lands involved met the requirements of regulations governing coal leasing on application (43 CFR 3425).

The BLM Wyoming State Director notified the Governor of Wyoming that Kiewit had filed a lease application with the BLM for the proposed tract on September 18, 2006. The PRRCT reviewed this lease application at a public meeting held in Casper, Wyoming, on April 19, 2006,

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[4] Chapter 7 includes a definition of the term "qualified surface owner," based on these regulations.

following Kiewit's presentation about the existing Buckskin Mine and the pending lease application for the proposed tract. The PRRCT recommended that the BLM continue to process this application. The major steps in processing an LBA are shown in appendix C.

The BLM published a notice of intent to prepare an environmental impact statement and notice of public meeting in the *Federal Register* on Friday, December 21, 2007. The publication announced the time and location of a public scoping meeting and requested public comment on the application. Letters requesting public comment and announcing the time and location of the public scoping meeting were mailed to all parties on the distribution list.

The BLM published a notice of public scoping meeting in the *Federal Register* and Gillette *News-Record* newspaper. A BLM news release announcing preparation of the Hay Creek II coal lease application EIS was issued on January 17, 2008. The public scoping meeting was held on January 31, 2008, in Gillette, Wyoming. At the public meeting, the BLM presented information and accepted public comments about the application.

Chapter 5 provides a list of all federal, state, and local governmental agencies that were consulted in preparation of this EIS, all contributors to the information provided in this document and the distribution list for this EIS.

1.6.1.1 Issues and Concerns

Issues and concerns expressed by the public and government agencies relating to the potential impacts of leasing the proposed tract, specifically, and/or to previous coal lease applications in general include:

- potential conflicts between coal mining and both existing and proposed conventional oil and gas development and CBNG development;
- potential cumulative impacts of coal leasing decisions combined with other existing and proposed development in the PRB;
- validity and currency of resource data;
- potential impacts on public access;
- potential impacts on cultural and paleontological resources;
- potential impacts on greater sage-grouse and other wildlife;
- potential impacts on threatened and endangered species and other species of concern;
- potential impacts on wetland resources;
- potential impacts related to coal loss during transport;
- potential impacts on air quality (including cumulative impacts on visibility);
- potential impacts on surface and groundwater quality and quantity;

- potential impacts of and possible mitigation for nitrogen oxide emissions resulting from blasting of coal and overburden;
- potential impacts on human health;
- the need to include reasonably foreseeable actions such as the construction and operation of the Dakota, Minnesota & Eastern Railroad and power plants in the cumulative analysis;
- the need to address coal combustion residues and other byproducts from coal-fired power plants;
- the need to address increasing coal production in the PRB in the cumulative analysis;
- the need to lease enough coal that the revenues generated are sufficient for use in the local community;
- the need to address site-specific greenhouse gas emissions; and
- climate change.

1.6.1.2 Draft Environmental Impact Statement

Copies of this draft EIS were sent to all parties on the distribution list and copies were made available for review at the BLM offices in Casper, Buffalo, and Cheyenne, Wyoming. The document is also available for review on the BLM Wyoming website at: http://www.blm.gov/wy/st/en/info/NEPA/cfodocs/HayCreekII.html.

The EPA will publish a notice in the *Federal Register* announcing the availability of the draft EIS. A 60-day comment period on the draft EIS will commence with publication of that notice. The BLM will also publish a notice of availability/notice of public hearing in the *Federal Register*. That notice will announce the date and time of a public hearing to be held during the 60-day comment period. The purpose of the hearing will be to solicit public comments on the draft EIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of federal coal from the proposed tract. The BLM will also publish a notice of public hearing in the *Gillette News-Record* and other local newspapers.

1.6.2 Future Involvement

1.6.2.1 Final Environmental Impact Statement

All substantive written comments received on the draft EIS will be included, with agency responses, in the final EIS. Both the BLM and the EPA will publish a notice of availability of the final EIS in the *Federal Register*. After a 30-day availability period, the BLM will make a decision to hold or not to hold a competitive lease sale for the federal coal reserves in the proposed tract.

1.6.2.2 Record of Decision

The record of decision (ROD) for the tract will be mailed to all parties on the mailing list and others who commented on the draft EIS during the comment period. Members of the public and/or the applicant can appeal the BLM decision to hold or not to hold a competitive sale and issue a lease for the final tract configuration. The BLM decision must be appealed within 30 days from the date that the notice of availability for the ROD is published in the *Federal Register*. The decision can be implemented at that time if no appeal is received. If a competitive lease sale is held, it will follow the procedures set forth in 43 CFR 3422, 43 CFR 3425, and BLM Handbook H-3420-1 (Competitive Coal Leasing).

1.6.2.3 Department of Justice Consultation

After a competitive coal lease sale, but before the lease is issued, the BLM must solicit the opinion of the U.S. Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The U.S. Department of Justice has 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, the BLM can issue the lease.

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2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the regulations and documents that guide the identification of alternatives to the Proposed Action, explains how the alternatives were developed and how a final tract configuration will be determined, and, finally, provides detailed descriptions of the Proposed Action, alternatives, and tract configurations considered in this EIS[1].

This draft EIS analyzes three alternatives: the Proposed Action, Alternative 1 (No Action), and Alternative 2 (additional lands added by the BLM). Two additional alternatives were considered but were not analyzed further in this EIS because they were not logistically feasible (Alternative 3 - new mine start) or substantially different (Alternative 4 – delay the lease sale) than analyzed alternatives. Supporting information for excluding these alternatives is provided in section 2.3.

In response to direction from the Department of Interior, the BLM has identified Alternative 2 as the preliminary Preferred Alternative in this draft EIS. However, the final Preferred Alternative cannot be developed until the BLM has considered all of the input received on the draft EIS from individuals, agencies, and other interested parties during the public comment period. The comment period begins when the BLM has issued a notice of availability of the draft EIS and lasts for 60 days. This process offers the public sector an opportunity to submit written input during the comment period and oral comments at a public hearing that occurs during that period. The BLM will consider comments on the environmental effects identified in the draft EIS, as well as fair market value and maximum economic recovery factors, geologic data, and coal data. The ultimate Preferred Alternative will be described and analyzed in the final EIS. The ROD will be issued and, if the decision is to offer the tract for lease, then a sale will be held. If a sale is held, the bidding would be open to any qualified bidder.

2.1. Background

To process an LBA, the BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal, and fulfill the requirements of NEPA by evaluating the environmental impacts of leasing that coal. NEPA also requires that the BLM consider and evaluate "reasonable alternatives" to meet the objectives of the Proposed Action while avoiding or minimizing environmental impacts. Reasonable alternatives are defined by NEPA as those that are technically, economically, and environmentally practical and feasible to satisfy the stated purpose and need for the proposed federal action. NEPA also requires the analysis of a "no action" alternative (i.e., the consequence of continuing ongoing activities without a new leasing action).

In addition to NEPA requirements, the BLM must meet the requirements contained in the *Competitive Coal Leasing Manual* (BLM 1989) and follow the regulations for federal coal leasing by application under 43 CFR 3425.1–9. Like NEPA, the *Competitive Coal Leasing*

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[1] Refer to page xiii for a list of abbreviations and acronyms used in this document.

Manual requires that the BLM evaluate other potential boundaries for federal coal tracts that include and/or are near the proposed tract.

In its consideration of alternative tract boundaries, the BLM must meet the following goals: 1) achieve maximum economic recovery of the coal resource; 2) maintain or increase the potential for competition; and 3) avoid future bypass or captive tract situations (i.e., stranding an isolated tract and hindering future recovery of those coal resources). In accordance with these goals, the BLM has identified an area encompassing the proposed tract and adjacent unleased federal coal reserves. This area is referred to as the BLM study area (map 2-1). Based on federal regulations (43 CFR 3425.1-9)[2], the BLM could decrease the size of the proposed tract or increase it to include some or all of the federal coal reserves in the BLM study area.

2.2. Description of the Proposed Action and Alternatives

Under the Proposed Action, the BLM would hold a competitive sale and issue a lease for the federal coal reserves included in the proposed tract, which is a contiguous block of federal coal reserves adjacent to existing coal leases at the Buckskin Mine (map 2-1). Two alternatives to the Proposed Action are analyzed in this EIS:

1. Alternative 1 (No Action): Reject the application to lease federal coal reserves in the proposed tract and not offer a tract for sale at this time.
2. Alternative 2 (the BLM preliminary Preferred Alternative): Hold a competitive sale and issue a lease for the federal coal reserves included in an alternative tract configuration that would be delineated from some or all of the BLM study area.

See section 2.3 for a discussion of other alternatives considered but eliminated from further analysis in this EIS.

Under the Proposed Action or Alternative 2, the Buckskin Mine permit area would be enlarged to include the newly leased tract before mining activities could begin. To do this, Kiewit would submit an application with WDEQ/LQD to amend its existing surface mining permit and mining plan, including corresponding monitoring and mitigation plans, to include the new lease area.

2.2.1. Proposed Action

Under the Proposed Action, the BLM would hold a competitive sale, as described under section 1.1.2, and would issue a lease for the federal coal reserves included in the proposed tract. The Proposed Action assumes that Kiewit would be the successful bidder and would incorporate the proposed tract into its existing mine operations. The Proposed Action would not expand operations at the Buckskin Mine, but would maintain current levels of production for an additional two years beyond the current life-of-mine estimate.

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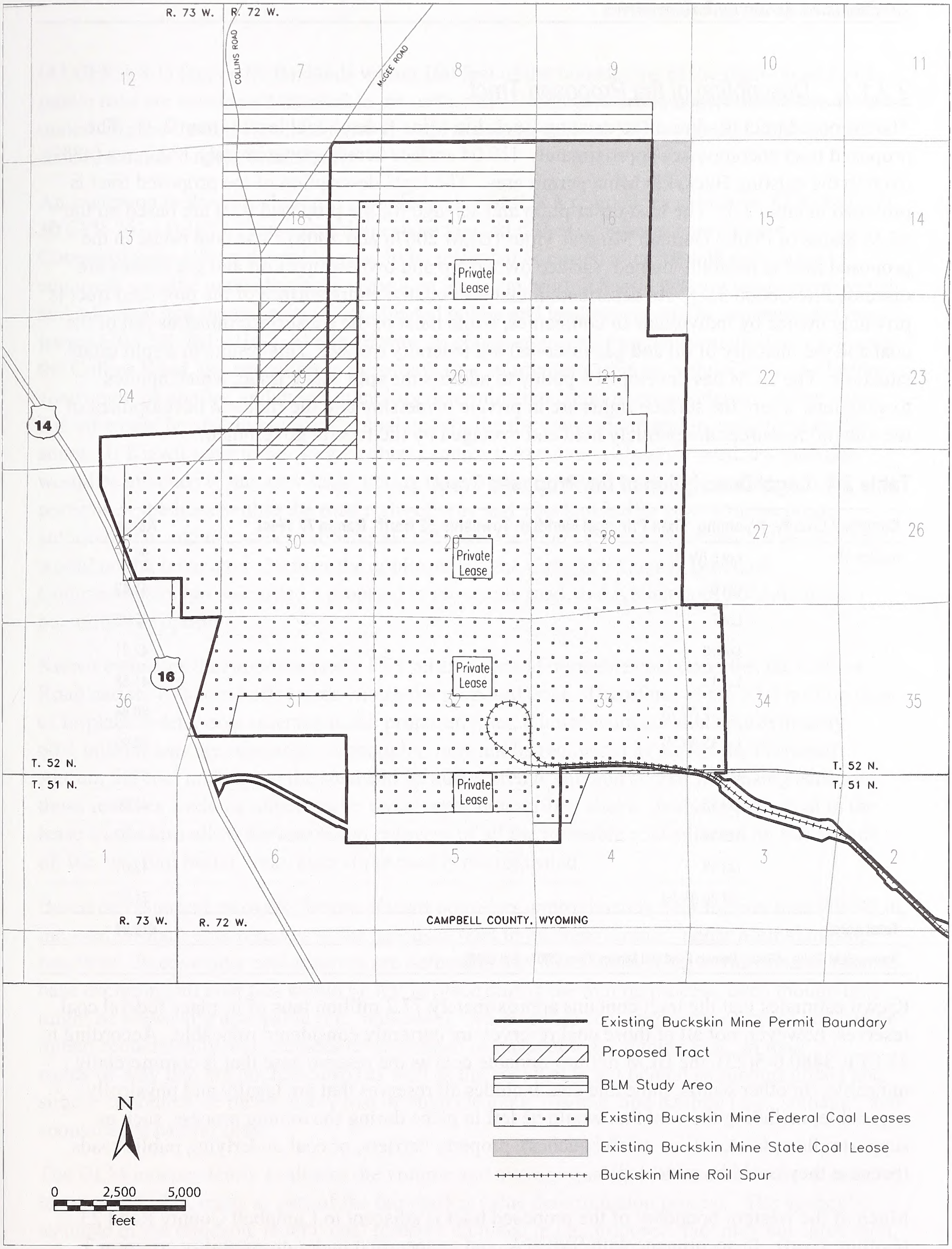
2 "The authorized officer may add or delete lands from an area covered by an application for any reason he/she determines to be in the public interest."



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 2-1

Proposed Tract and BLM Study Area

2.2.1.1. Description of the Proposed Tract

The proposed tract is adjacent to existing Buckskin Mine federal coal leases (map 2-1). The proposed tract encompasses approximately 419.04 surface acres; approximately 182 acres (43%) overlap the existing Buckskin Mine permit area. The legal description of the proposed tract is provided in table 2-1. The land description and acreage for the proposed tract are based on the BLM Status of Public Domain Mineral Titles (BLM 2007a and 2008). The coal estate in the proposed tract is federally owned; surface ownership and ownership of oil and gas estates are discussed in section 3.11. As described in that section, the entire surface of the proposed tract is privately owned by individuals or companies, while most of the subsurface minerals (all of the coal and the majority of oil and gas reserves) are federally owned. This results in a split estate situation. The BLM has developed a policy to address the split estate issue, which applies to situations where the surface rights are in private ownership and the rights to development of the mineral resources are publicly held and managed by the federal government.

Table 2-1. Legal Description of the Proposed Tract

Campbell County, Wyoming, Sixth Principal Meridian Township 52 North, Range 72 West		Acres
Section 19:	Lot 5 (W ½)	20.71
	Lot 6	41.42
	Lot 7	42.45
	Lot 10	42.31
	Lot 11	41.68
	Lot 12 (W ½)	20.84
	Lot 13 (W ½)	20.93
	Lot 14	41.75
	Lot 15	41.90
	Lot 18	41.97
	Lot 19	42.01
	Lot 20 (W ½)	21.07
Total Acres		**419.04**

Source: BLM Status of Public Domain Land and Mineral Titles (2007a and 2008).

Kiewit estimates that the tract contains approximately 77.2 million tons of in-place federal coal reserves; however, not all of those coal reserves are currently considered mineable. According to 43 CFR 3480.0-5(23), the BLM defines minable coal as the reserve base that is commercially mineable. In other words, mineable coal includes all reserves that are legally and physically accessible, including the coal that would be left in place during the mining process, such as support pillars, fenders (i.e., catch benches), property barriers, or coal underlying public roads (because they could be relocated).

Much of the western boundary of the proposed tract is adjacent to Campbell County Road 23 (Collins Road). In accordance with SMCRA, and as specified under unsuitability criterion 3

(43 CFR 3461) (appendix B), lands within 100 feet of the outside line of the right-of-way of a public road are considered unsuitable for surface coal mining. Consequently, the coal reserves underlying the Collins Road, its right-of-way, and an associated 100-foot buffer zone cannot be accessed under current conditions.

An exception to this prohibition is included in the SMCRA regulations at Section 522(e)(4) and 30 CFR 761.11(d)(2). This exception can be applied if the Campbell County Board of Commissioners allows the public road to be relocated or closed after the following have occurred: a public notice has been issued, an opportunity for a public hearing has been provided, and a finding that the interests of the affected public and landowners will be protected has been issued (30 CFR 761.11[d]). If Kiewit were to obtain approval from the commissioners to move the Collins Road, the exception to the prohibition on mining within its right-of-way and buffer zone could be applied and the unsuitability determination could be reconsidered. In that case, Kiewit would be able to recover the coal underlying the county road and its associated buffer zones. If Kiewit were to not seek or obtain approval to move or close the road, a stipulation would be attached to any new lease stating that no mining activity may be conducted in the portions of the lease within the road right-of-way and 100-foot buffer zone without proper authorization, and the associated federal coal reserves would remain unsuitable for mining and would not be recovered. Neither the applicant nor the Campbell County Board of Commissioners has submitted a proposal to move this road, and Kiewit does not anticipate pursuing that option.

Kiewit estimates that approximately 17.1 million tons of mineable coal underlies the Collins Road and its 100-foot buffer zone within the proposed tract. Therefore, of the 77.2 million tons of in-place federal coal reserves in the proposed tract, Kiewit estimates that approximately 60.1 million tons are mineable. Although it may not be recovered as part of the Proposed Action, the coal underlying the road and its buffer area is still considered for leasing because those reserves could be mined under the exception described above. Including this coal in the lease would also allow for maximum recovery of all the mineable coal adjacent to, but outside of, the 100-foot buffer zone, even if the road is not relocated.

Based on historical recovery factors, Kiewit considers approximately 54.1 million tons (70 %) of the total in-place coal reserves in the proposed tract to be "recoverable" under normal mining practices. Recoverable coal reserves are defined in 43 CFR 3480.0-5(32) as the minable reserve base excluding all coal that would be left in place during the mining process, even though they might be physically accessible (i.e., mineable). Recoverable coal represents reserves that can be mined economically and excludes areas defined as unsuitable for mining (e.g., in road rights-of-way that are not relocated) as well as the coal that is left behind as support pillars and similar structures, or unavoidably lost through cleaning, loading, and hauling (e.g., spillage), and spontaneous natural fires.

The BLM independently evaluates the volume and average quality of the coal resources included in proposed LBA tracts as part of the fair market value determination process. The agency's estimate of the mineable federal coal reserves included in the proposed tract may not agree with

the mineable coal reserve and coal quality estimates provided by the applicant. The BLM estimate would be published in the official notice if the tract is offered for sale.

Under its currently approved mining plan, the Buckskin Mine would retrieve its remaining 344.3 million tons of recoverable coal reserves in approximately 14 years, beginning in January 2009. The mine's current air quality permit as approved by the WDEQ/AQD allows mining of as much as 42 million tons of coal per year. Annual production averaged 20.6 million tons from 2002 through 2007, with a maximum of 25.3 million tons in any single year (Buckskin Mining Company 2002, 2003, 2004, 2005, 2006, and 2007). Under the Proposed Action, Kiewit estimates that the life of the mine would be extended by an additional two years, with an average production rate of 25 million tons per year. Additional details about existing coal reserves and tons mined to date are provided in section 1.1.3.1.

2.2.1.2. Mine Facilities and Employees

Under the Proposed Action, the recovery of additional federal coal reserves would use the existing mine facilities and employees described under section 1.1.3.2. The Proposed Action would not require additional facilities or employees.

2.2.1.3. Mining Methods and Activities

Under the Proposed Action, coal would continue to be produced at the Buckskin Mine from the Anderson and Canyon coal seams, and current production methods would be the same as those described under section 1.1.3.3.

The design of the Buckskin Mine seeks to confine disturbance to the active mine blocks. Before any surface disturbance or other mine-related activities would begin in the proposed tract, support infrastructure such as roads, power lines, gas pipelines, and flood- and sediment-control features would be built or relocated, as needed; no public roads are currently being considered for construction or relocation. Topsoil and overburden removal is accomplished using a variety of suitable heavy equipment. Whenever possible, topsoil would be hauled directly to a reclamation area and overburden to open pits; however, if scheduling conflicts arise, they would be temporarily stockpiled in separate areas and topsoil piles would be seeded to prevent erosion. Overburden and coal removal has been and would continue to be conducted using blasting, trucks and shovels to facilitate efficient excavation.

2.2.1.4. Reclamation Activities

Reclamation activities under the Proposed Action would be consistent with those currently in use at the Buckskin Mine, described in section 1.1.3.4.

Mined-out areas would be restored to recreate the original contours or other topographic configurations to the extent possible. The approximate original drainage pattern of all streams within affected areas would also be restored (section 3.5). In-channel stockponds and playas (shallow topographic depressions) would be replaced to provide livestock and wildlife watering sources. All postmining topography, including reconstructed drainages, must be approved by the

WDEQ/LQD. After mining, the land is reclaimed to support the premining uses described in section 1.1.3.1. Oil and gas wells, pipelines, and utility easements are reestablished as required.

The reclaimed area would be monitored for a minimum of 10 years to evaluate the success of vegetation growth and the establishment of a variety of plant species prior to the final (Phase III) release of the reclamation bond. Other parameters, such as successful use of reclaimed areas by livestock and wildlife, also must be demonstrated before Phase III bond release is achieved, as described in section 1.1.3.4.

2.2.2. Alternative 1 (No Action)

Under Alternative 1, the No Action Alternative, Kiewit's application to lease the coal included in the proposed tract would be rejected: federal coal reserves adjacent to the existing Buckskin Mine would not be offered for competitive sale, and the additional coal would not be mined.

For the purposes of this EIS, Alternative 1 assumes that the federal coal reserves adjacent to the Buckskin Mine would not be mined in the foreseeable future. However, selection of this alternative would not preclude Kiewit or another company from submitting a future lease application for these adjacent coal reserves. The tract could be leased as a maintenance lease while the adjacent mine is in operation. If it is not leased while the adjacent mine is in operation, it may or may not be leased in the future. The tract evaluated in this EIS does not include enough coal reserves to justify starting a new mine (section 2.3.1); however, the coal reserves included in the tract could be combined with unleased federal coal reserves to the west and north to create a larger tract, which could be mined by a new future operation.

2.2.2.1. Description of Overlap Area

Under Alternative 1, currently permitted mining activities associated with existing coal leases at the Buckskin Mine would not be affected. Approximately 182 acres of the proposed tract and 436.5 additional acres of the BLM study area (618.5 total acres) overlap the existing permit boundary. Therefore, under the No Action Alternative, surface disturbance would occur in this overlap area, but would be limited to highwall reduction, topsoil removal, and other mine support activities related to mining under the existing contiguous leases.

Under Alternative 1, average annual production would continue as described under section 1.3.1.1.

2.2.2.2. Mine Facilities and Employees

Under Alternative 1, mine facilities and employees would continue as described under section 1.1.3.2.

2.2.2.3. Mining Methods and Activities

Under Alternative 1, mining methods and activities would continue as described under section 1.1.3.3.

2.2.2.4. Reclamation Activities

Under Alternative 1, reclamation activities would continue as described under section 1.1.3.4.

2.2.3. Alternative 2

Under Alternative 2, the BLM would hold a competitive sale, as described under section 1.1.2, and would issue a lease for the federal coal reserves included in an alternative tract configuration. The alternative tract configuration would be defined by the BLM from lands within the BLM study area (map 2-1) to be technically, economically, and environmentally preferable to the proposed tract. The alternative tract configuration could be smaller than the proposed tract, or include part or all of the BLM study area.

As under the Proposed Action, Alternative 2 assumes that Kiewit would be the successful bidder and would incorporate an alternative tract configuration into its existing mine operations. Alternative 2 would not expand operations at the Buckskin Mine, but would maintain current levels of production, described in section 1.1.3.1, for six years beyond the current life-of-mine estimate.

2.2.3.1. Description of the BLM Study Area

The BLM study area extends north and west of the proposed tract to encompass approximately 1,883 acres (map 2-1). As described under the No Action Alternative, approximately 436.5 acres (23%) of the BLM study area overlap the existing mine permit area. The legal description of the area is provided in Table 2-2.

Table 2-2. Legal Description of the BLM Study Area

Campbell County, Wyoming, Sixth Principal Meridian Township 52 North, Range 72 West	Acres
Section 7: Lots 17 through 20	166.91
Section 8: Lots 13 through 16	162.00
Section 9: Lots 13 through 15	120.58
Section 17: Lots 1 through 4, 5 (N. ½), 6 (N. ½), 7 (N. ½), and 8 (N. ½)	247.39
Section 18: Lots 5 through 11, 12 (N. ½, SW. ¼), 13 (W. ½), 14 through19, and 20 (W. ½)	612.95
Section 19: Lots 5 (W. ½), 6 through 11, 12 (W. ½), 13 (W. ½), 14 through 19, and 20 (W. ½)	573.27
Total Acres	**1,883.10**

BLM = U.S. Bureau of Land Management
Source: BLM Status of Public Domain Land and Mineral Titles (2007a and 2008).

The land descriptions and acreages shown in table 2-2 are based on the same BLM master title plats and coal plats as those listed under section 2.2.1.1 for the Proposed Action. Surface ownership and ownership of oil and gas estates are discussed in section 3.11. In addition to existing surface disturbance associated with the Buckskin Mine, the BLM study area includes small crop areas, two Campbell County roads (the Collins Road and Campbell County Road 73

[McGee Road]), several overhead electric transmission lines, oil and gas pipelines, and three residences. Only one of the three residences is currently occupied.

The coal underlying the Collins and McGee roads and their rights-of-way and associated 100-foot buffer zones have been determined unsuitable for surface coal mining in accordance with SMCRA and as specified under unsuitability criterion 3 (43 CFR 3461), unless the applicant pursues an exception to this prohibition by obtaining authorization to close or relocate one or both roads. Under the same unsuitability criterion, the land underlying the occupied residence, discussed above, is also considered unsuitable for mining. Surface disturbance on this land and a 300-foot buffer around it would be prohibited, unless Kiewit were to purchase the surface rights associated with the residence and its buffer zone.

Kiewit does not currently plan to pursue efforts to relocate either county road or acquire the surface rights to the land associated with the occupied residence; therefore, the company considers the lands around those features inaccessible and operationally limited. Nevertheless, the coal underlying these features and their respective buffer areas must be considered for leasing by the BLM because those reserves could be mined under the exceptions for unsuitability criterion 3 described in section 2.2.1.1. Including these operationally limited coal reserves in the lease would also allow for maximum recovery of all adjacent mineable coal. Although the coal itself may not be recovered, the surface above the coal would allow for overstripping and other disturbance activities necessary to access previously permitted adjacent reserves. If a lease is issued for lands within the BLM study area, a stipulation will be attached to the lease stating that no mining activity may be conducted within the areas currently identified as unsuitable for mining without proper authorization or acquisition of surface rights, as applicable.

Kiewit estimates that the BLM study area contains approximately 269.7 million tons of in-place coal, and considers approximately 149.7 million tons (56%) of it recoverable. Approximately 103.4 million tons (38%) of coal would not be accessible (according to Kiewit's estimates) because of limitations associated with the occupied residence and public road rights-of-way and buffer zones discussed above. Kiewit estimates that the remaining 16.6 million tons (6%) of coal would be left in place as support pillars and similar structures, or unavoidably lost through spillage and spontaneous natural fires. As for the Proposed Action, the BLM independently evaluates the volume and average quality of the coal resources included in the BLM study area as part of the fair market value determination process. This estimate may not agree with the estimates provided by the applicant. The BLM estimate would be published in the public notice if a tract is offered for sale.

2.2.3.2. Mine Facilities and Employees

Under Alternative 2, Kiewit estimates the life of the mine would be extended by six years with an average annual production rate of 25 million tons. Mine facilities and employees would be the same as those described in section 1.1.3.2 and under the Proposed Action.

2.2.3.3. Mining Methods and Activities

Mining methods and activities would be the same as those described in section 1.1.3.3 and under the Proposed Action.

2.2.3.4. Reclamation Activities

Reclamation activities would be the same as those described in section 1.1.3.4 and under the Proposed Action.

2.3. Eliminated Alternatives

The following alternatives were considered in the initial phase of this EIS, but were eliminated from further analysis.

2.3.1. Alternative 3

The environmental impacts of developing a new mine to recover the coal resources within the proposed tract or an alternative tract configuration would be greater than under either action alternative or the No Action Alternative due to the need for construction of new facilities and rail lines, increased employment requirements and their associated effects on the local socioeconomics, and the creation of additional sources of particulates (dust).

Under this alternative, the BLM would hold a competitive, sealed-bid sale for the federal coal reserves included in the proposed tract or an alternative tract configuration. Alternative 3 assumes, however, that the successful bidder would be someone other than the applicant, and that this bidder would plan to open a new mine to develop these coal resources.

The BLM currently estimates that a tract would need to include as much as 500 to 600 million tons of in-place coal to attract a buyer interested in opening a new mine in the Wyoming PRB. This estimate is based on two primary assumptions. First, an operator would need to construct facilities capable of producing 30 million tons of coal per year to take advantage of the economies of scale offered by the coal deposits in the PRB. Second, 20 to 30 years of coal reserves would be needed to justify the expense of building those facilities. Given these assumptions, neither the proposed tract (approximately 77 million tons) nor the BLM study area (about 270 million tons) includes sufficient in-place coal resources to justify the costs of opening a new mine, though the coal reserves included in this EIS could be combined with unleased federal coal to the west and north to create a larger tract, which could be mined by a new future operation.

A company or companies acquiring this coal for a new stand-alone mine would require considerable initial capital investments, including the construction of new surface facilities (e.g., offices, shops, warehouses, processing facilities, loadout facilities, and rail spur), extensive baseline data collection, and development of new, detailed mining and reclamation plans (rather than simply amending existing plans). A new mine start would also require a large number of

new employees, which may not be available from the mining sector workforce (which includes the oil and gas industry) considering the current strong demand for labor and low unemployment in Campbell County and surrounding counties in the PRB. In addition, a company or companies acquiring this coal for a new mine would have to compete for customers with established mines in a competitive market. Based on demand forecasting for the Wyoming PRB mines, existing mine capacity is sufficient to provide for expected coal demand through 2020 (BLM 2005b). While these factors do not mean that no new mines would open, it would be difficult for them to produce coal at a price competitive with the existing operations while also incurring the high capital and start-up costs associated with new facilities and operations.

The potential difficulty in obtaining an air quality permit is another factor that could discourage new mine starts in the Wyoming PRB. A new mine would constitute a new source of air pollutants. Under the WDEQ/AQD permitting program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit prior to construction. Surface coal mines fall into this category. Air quality is discussed in detail in section 3.4.

To obtain a construction permit, an operator may be required to demonstrate that the proposed activities would not increase air pollutant levels above the state's 24-hour average annual standards for particulate matter measuring 10 micrometers or less in diameter (PM_{10}). These standards were established by the Wyoming Air Quality Standards and Regulations (Chapter 6), and can be found on the Internet at http://deq.state.wy.us/aqd/standards.asp. The PRB did not experience any exceedances of these PM_{10} standards through 2000, but recorded an average of five per year from 2001 through 2007; additional details regarding exceedances at the Buckskin Mine are provided in section 3.4. Although many of the previous exceedances were attributed to high winds, concerns about future potential exceedances of the National Ambient Air Quality Standards (NAAQS) may make it more difficult for a company planning to open a new mine to demonstrate that those operations would not result in additional air pollution levels that are above annual Wyoming standards.

If a lease sale is held and the successful bidder is not the original applicant, the new operator would be required to submit a new permit application, including detailed mining, monitoring, mitigation, and reclamation plans (versus a simple amendment of current plans) to the WDEQ/LQD for review. The new operator would also be required to submit a Resource Recovery and Protection Plan to the BLM for review. Before a new mining operation could begin, a Resource Recovery and Protection Plan must be approved by the BLM, a mining permit must be approved by WDEQ/LQD, and a Mineral Leasing Act mining plan must be approved by the Assistant Secretary of the Interior.

In view of these issues, the current economies of mining in the Powder River Federal Coal Region appear to make construction of a new mine economically unfeasible using coal reserves in the proposed tract or BLM study area. Therefore, this alternative is not analyzed further in this EIS.

2.3.2. Alternative 4

Under Alternative 4, the BLM would delay the sale of federal coal reserves in the proposed tract and BLM study area. Under this alternative, it is assumed that a tract could be developed later as either a maintenance tract for an existing mine or a new mine start, depending on how long the sale was delayed. Alternative 4 was not analyzed in detail because it would not produce substantially different impacts from other alternatives that were analyzed in more detail. The environmental impacts of mining the coal later as part of an existing mine would be expected to be similar and essentially equal to the action alternatives discussed previously (section 2.2.1 and section 2.2.3). As discussed in section 2.3.1, the environmental impacts from a new mine start would be expected to be greater than if the coal reserves were mined as an extension of an existing mine.

Delaying the lease sale would not guarantee that the BLM would receive a higher price during the initial bidding process, or a higher bonus bid or royalties and taxes once the lease is issued due to other reasons that may or may not be related to the quality and/or location of the coal reserves themselves. The price of coal and, thus, the rate of mining, is affected by various factors including, but not limited to, customer demand (sales) and transportation options. For example, coal prices were depressed in the early 2000s, which resulted in lower bid prices during that period. Conversely, damage to train tracks in Wyoming and other states limited coal shipments during much of 2005. Those shipping constraints, combined with increased world energy demand and numerous natural disasters in other parts of the country, led to unusually large increases in coal prices that year.

The prices received for coal from the PRB have generally been increasing in recent years. If that trend continues, the fair market value of federal coal reserves could increase and a delayed sale would result in a higher lease bid, as well as higher bonus bid and royalty payments to the government when the lease is issued and coal is mined, respectively. This approach also would allow CBNG resources to be more completely recovered prior to mining. Likewise, if the fair market value of the coal reserves were to decrease, a delayed sale would bring lower initial and bonus bids as well as lower royalty, tax, and annual rental payments.

Royalty and tax payments are the largest revenue sources from new leases, but cannot be collected until the coal is permitted and mined; this process requires several years after the lease is issued. Therefore, the price of coal when it is mined (and essentially sold to the customer) affects royalty and tax payments. Higher coal prices result in greater royalty and tax payments, regardless of whether coal lessees have short- or long-term contracts with their customers. The reverse is true when coal prices decrease.

Other considerations include the value of making low-sulfur coal available now versus leaving mineable coal in place for future development, in anticipation of cleaner fuel sources being developed in the future. Continued leasing of low-sulfur coal from the PRB enables existing coal-fired power plants to more easily meet current CAA requirements until new technologies are developed to improve efficiency and reduce emissions. This approach provides a stable supply of power to meet increasing demand without a potentially significant increase in power costs for individuals and businesses, and meets current energy requirements while the new

technologies are developed. If cleaner fuel sources are developed in the future, they could be phased in with less economic impact on the public. An economic analysis could be conducted to estimate the range of potential future economic benefits that would result from delaying the lease sale until coal prices rise. However, because it is impossible to predict with any certainty when or if those rates would increase, any projected benefits from delaying the lease sale would be speculation.

CBNG resources are currently being recovered from leases in and near the proposed tract and BLM study area. As of May 2008, 30 permits had been issued for drilled or proposed well sites on lands in the BLM study area. Of those, 12 have expired without drilling, 3 are reported as plugged and abandoned, and 15 are currently producing. Another 12 wells are producing CBNG in the area immediately surrounding the BLM study area. Additional information relative to conventional oil and gas and CBNG development in the proposed tract and immediately adjacent area is provided in section 3.3.2.

Several existing mechanisms can facilitate the continued recovery of these oil and gas resources prior to mining if the federal coal in the proposed tract or an alternative tract configuration is leased under the current timeline:

- The BLM can attach a Multiple Mineral Development stipulation to the lease. Such a stipulation would state that the BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease.
- Mining the proposed tract or alternative tract configuration cannot occur until the coal lessee has a permit to mine the tract as approved by the WDEQ/LQD and a Mineral Leasing Act mining plan approved by the Secretary of the Interior. Before that mining plan can be approved, the BLM must approve the Resource Recovery and Protection Plan for mining the tract. Prior to approving the plan, the BLM can review the status of CBNG development in the final tract configuration and the mining sequence proposed by the coal lessee. The permit approval process generally takes several years to complete. This interval would allow additional time for CBNG resources to be recovered from the leased tract.
- The BLM has a policy in place regarding conflicts between CBNG and coal recovery. This policy directs the BLM decision makers to optimize the recovery of both resources and to ensure that the public receives a reasonable return (BLM 2006a).

As described previously, rental and royalty provisions from the proposed tract or an alternative tract configuration would benefit the U.S. if coal prices increased by the time mining began. Given the mechanisms currently in place, a large portion of the economically recoverable CBNG resources in the area would be expected to be recovered after a lease is issued and before mining occurred. The environmental impacts of mining the coal later as part of an existing mine would be expected to be similar and essentially equal to the action alternatives discussed in section 2.2.1 and section 2.2.3. If a new mine is required to mine the coal, the environmental impacts would be expected to be greater than if each tract were mined as an extension of an existing mine.

2.4. Regulatory Compliance, Mitigation, and Monitoring

In general, the levels of mitigation and monitoring required for surface coal mining by the SMCRA and Wyoming state law are more rigorous and extensive than those required for other surface disturbing activities. Those regulations and laws require surface coal mines to collect a wide range of detailed baseline information, and implement extensive mitigation measures and monitoring programs. The currently approved permit to conduct mining operations for the Buckskin Mine includes these requirements (i.e., the No Action Alternative).

Required mitigation and monitoring programs are also considered to be part of the action alternatives considered in this EIS. These data collection requirements, monitoring commitments, and mitigation plans would be extended to include mining operations in the proposed tract or alternative tract configuration if they are leased and permitted for mining. A mining and reclamation plan would have to be approved for the final tract configuration before any mining operations could be conducted there, regardless of who acquires the tract. The major mitigation and monitoring measures that are required by state or federal regulation are summarized in table 2-3. Specific information about some of these measures (including their results at the Buckskin Mine) is included in chapter 3. If impacts are identified during the leasing process that are not addressed by existing required mitigation measures, the BLM can require additional measures in the form of stipulations on the new lease within the limits of its regulatory authority. The mining and reclamation plan would have to be revised to address any new concerns that are not included under existing procedures.

Table 2-3. Regulatory Compliance, Mitigation, and Monitoring Measures for Surface Coal Mining Operations Legally Required for All Alternatives

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State, or Federal Law[1]	Monitoring[1]
Topography and Physiography	▪ Restoring to approximate original contour or other approved topographic configuration	▪ WDEQ/LQD checks as-built vs. approved topography with each annual report
Geology and Minerals	▪ Identifying and selectively placing or mixing chemically or physically unsuitable overburden materials to minimize adverse effects on vegetation or groundwater	▪ WDEQ/LQD requires monitoring in advance of mining to detect unsuitable overburden
Soil	▪ Salvaging soil suitable to support plant growth for use in reclamation ▪ Protecting soil stockpiles from disturbance and erosional influences ▪ Selectively placing at least 4 feet of suitable overburden on the graded backfill surface below replaced topsoil to meet guidelines for vegetation root zones	▪ Monitoring vegetation growth on reclaimed areas to determine need for soil amendments ▪ Sampling regraded overburden for compliance with root zone criteria

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State, or Federal Law[1]	Monitoring[1]
Air Quality	▪ Dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air ▪ Using particulate pollution control technologies ▪ Using work practices designed to minimize fugitive particulate emissions ▪ Using EPA or state-mandated best available control technology, including: – Fabric filtration or wet scrubbing of coal storage silo and conveyor vents – Watering or using chemical dust suppression on haul roads and exposed soils – Containing truck dumps and primary crushers – Covering conveyors – Promptly revegetating exposed soils – High-efficiency baghouse dust collection systems or passive enclosure control systems or atomizers/foggers on the crusher, conveyor transfer, storage bin and train loadout, meeting a standard of 0.01 grains per dry standard cubic foot of exit volume – Watering active work areas – Reclamation planning to minimize surface disturbances subject to wind erosion – Paving access roads – Haul truck speed limits – Limited material drop heights for shovels and draglines ▪ Following voluntary and required measures to avoid exposing the public to NO_2 from blasting clouds, including: – Phoning neighbors and workers to notify them prior to blasting – Monitoring weather and atmospheric conditions prior to decisions to blast – Timing blasts to avoid temperature inversions and to minimize inconvenience to neighbors – Closing public roads when appropriate to protect the public – Minimizing blast sizes – Posting signs on major public roads	▪ On-site air quality monitoring for PM_{10} and/or TSP ▪ Off-site ambient monitoring for PM_{10} and/or TSP ▪ On-site compliance inspections
Surface Water	▪ Building and maintaining sediment-control ponds or other devices during mining ▪ Restoring approximate original drainage patterns during reclamation ▪ Restoring stockponds and playas during reclamation	▪ Monitoring storage capacity in sediment ponds ▪ Monitoring quality of discharges ▪ Monitoring streamflow and water quality
Groundwater Quantity	▪ Evaluating cumulative impacts on water quantity associated with proposed mining ▪ Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity	▪ Monitoring wells ▪ track water levels in overburden, coal, interburden, underburden, and backfill
Groundwater Quality	▪ Evaluating cumulative impacts on water quality associated with proposed mining ▪ Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality	▪ Monitoring wells ▪ track water quality in overburden, coal, interburden, underburden, and backfill
Alluvial Valley Floors	▪ Identifying all AVFs that would be affected by mining ▪ WDEQ/LQD determination of significance to agriculture of all identified AVFs affected by mining ▪ Protecting downstream AVFs during mining ▪ Restoring essential hydrologic function of all AVFs affected by mining	▪ Monitoring to determine restoration of essential hydrologic functions of any declared AVF

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State, or Federal Law[1]	Monitoring[1]
Wetlands	▪ Identifying all wetlands that would be affected by mining ▪ U.S. Army Corps of Engineers identification of jurisdictional wetlands ▪ Replacing all jurisdictional wetlands that would be disturbed by mining ▪ Replacing functional wetlands as required by surface managing agency, surface landowner, or WDEQ/LQD	▪ Monitoring reclaimed wetlands using same procedures used to identify premining jurisdictional wetlands
Vegetation	▪ Permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved permanent reclamation seed mixtures consisting predominantly of species native to the area ▪ Reclaiming 20% of reclaimed area with native shrubs at a density of one per square meter ▪ Controlling erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures ▪ Chemically and mechanically controlling weed infestation ▪ Directly hauling topsoil ▪ Selectively planting shrubs in riparian areas ▪ Planting sagebrush ▪ Creating depressions and rock piles ▪ Using special planting procedures around rock piles ▪ Posting reclamation bond covering the cost of reclamation	▪ Monitoring revegetation growth and diversity until release of final reclamation bond (minimum 10 years) ▪ Monitoring erosion to determine need for corrective action during establishment of vegetation ▪ Use of controlled grazing during revegetation evaluation to determine suitability for postmining land uses
Wildlife and Sensitive Species	▪ Restoring premining topography to the maximum extent possible ▪ Planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife ▪ Designing fences to permit wildlife passage ▪ Raptor-proofing power transmission poles ▪ Using raptor-safe power lines ▪ Creating artificial raptor nest sites ▪ Increasing habitat diversity by creating rock clusters and shallow depressions on reclaimed land ▪ Planting cottonwoods along reclaimed drainages ▪ Replacing drainages, wetlands, and AVFs disturbed by mining ▪ Reducing vehicle speed limits to minimize mortality ▪ Instructing employees not to harass or disturb wildlife ▪ Following USFWS approved avian mitigation plans ▪ Avoiding bald eagle disturbance ▪ Restoring bald eagle perching and foraging areas disturbed by mining ▪ Restoring sage-grouse and mountain plover habitat disturbed by mining ▪ Surveying for sage-grouse, mountain plovers, and black-tailed prairie dogs	▪ Baseline and annual wildlife monitoring surveys ▪ Monitoring for Migratory Bird Species of Management Concern in Wyoming
Threatened, Endangered, Proposed, and Candidate Species	▪ Surveying for Ute ladies'-tresses and blowout penstemon ▪ USFWS block clearance from black-footed ferret surveys in project area ▪ Same as Wildlife and Sensitive Species above	▪ Baseline and annual wildlife monitoring surveys
Land Use	▪ Suitably restoring reclaimed area for historic uses (grazing and wildlife)	▪ Monitoring of controlled grazing prior to bond release evaluation

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State, or Federal Law[1]	Monitoring[1]
Cultural Resources	▪ Conducting pre-disturbance Class I and III surveys to identify cultural properties on all state and federal lands, and on private lands affected by federal undertakings ▪ Consulting with SHPO to evaluate eligibility of cultural properties for the NRHP ▪ Avoiding or recovering data from significant cultural properties identified by surveys, according to an approved plan ▪ Notifying appropriate agency personnel if historic or prehistoric materials are uncovered during mining operations ▪ Instructing employees of the importance of and regulatory obligations to protect cultural resources	▪ Monitoring mining activities during topsoil stripping ▪ Ceasing activities and notifying authorities if unidentified sites are encountered during topsoil removal
Native American Concerns	▪ Notifying Native American tribes with known interest in this area of leasing action and requesting help in identifying potentially significant religious or cultural sites	▪ No specific monitoring program
Paleontological Resources	▪ Conducting pre-disturbance surveys to identify paleontological resources on all state and federal lands, and on private lands affected by federal undertakings ▪ Notifying appropriate agency personnel if potentially significant paleontological sites are discovered during mining ▪ Instructing employees of the importance of and regulatory obligations to protect paleontological resources	▪ Ceasing activities and notifying authorities if unidentified resources are encountered during topsoil removal
Visual Resources	▪ Restoring landscape character during reclamation through return to approximate original contour and revegetation with native species	▪ No specific monitoring program; land contours and plant communities monitored as part of topography and vegetation requirements, respectively
Noise	▪ Protecting employees from hearing loss	▪ Mine Safety and Health Administration inspections
Transportation Facilities	▪ Relocating existing pipelines, if necessary, in accordance with specific agreement between pipeline owner and coal lessee	▪ Monitoring conducted by pipeline company per WDEQ requirements
Socioeconomics	▪ Paying royalty and taxes as required by federal, state, and local regulations. No mitigation measures are proposed	▪ Surveying and reporting to document volume of coal removed
Hazardous and Solid Waste	▪ Disposing solid waste and sewage within permit boundaries according to approved plans ▪ Storing and recycling waste oil ▪ Maintaining files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during course of mining ▪ Ensuring that all production, use, storage, transport, and disposal of hazardous materials are in accordance with applicable existing or hereafter promulgated federal, state, and government requirements ▪ Complying with emergency reporting requirements for releases of hazardous materials as established under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended ▪ Preparing and implementing spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to section 312 of Superfund Amendments and Reauthorization Act, as amended ▪ Preparing emergency response plans.	▪ No specific monitoring other than required by these other regulations and response plans

WDEQ/LQD = Wyoming Department of Environmental Quality/Land Quality Division; PM_{10} = particulate matter of 10 micrometers or less in diameter; TSP = total suspended particulates; EPA = Environmental Protection Agency; NO_2 = nitrogen dioxide; AVF = alluvial valley floors; USFWS = U.S. Fish and Wildlife Service; SHPO = State Historic Preservation Office; NRHP = National Register of Historic Places.

[1] These requirements, mitigation plans, and monitoring plans are required by SMCRA and Wyoming state law. They are already in place for the existing Buckskin Mine in its current approved WDEQ/LQD mining and reclamation plan (the No Action Alternative). Under the Proposed Action and Alternative 2, these requirements, mitigation plans, and monitoring plans would need to be addressed in a mining plan revision for the additional leased tract; they would need to be approved before mining could occur.

Source: WDEQ Rules and Regulations.

If impacts are identified during the leasing process that are not addressed by existing required mitigation measures, the BLM can require additional mitigation measures (stipulations) on the new lease within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Wyoming state law are more extensive than those required for other surface-disturbing activities; however, concerns are periodically identified that are not monitored or mitigated under existing procedures.

2.5. Summary of Coal Production and Disturbance under the Proposed Action and Alternatives

The decision-making process for public lands and/or federal minerals in Wyoming is conducted in compliance with NEPA, which requires all federal agencies to:

- involve the interested public in their decision-making process;
- consider reasonable alternatives to the proposed actions;
- develop measures to mitigate environmental impacts; and
- prepare environmental documents that disclose the impacts of the proposed actions and alternatives.

Table 2-4 describes projected coal production, surface disturbance, mine life, and federal and state revenues for the Buckskin Mine under the Proposed Action and alternatives. These figures are based on an average production rate of 25 million tons per year, which is the current projected life-of-mine rate.

Detailed discussions of the direct and indirect environmental impacts under the Proposed Action and analyzed alternatives are provided in chapter 3; a summary of those impacts is provided in table 3-2. Cumulative environmental impacts under the Proposed Action and each analyzed alternative are discussed in chapter 4, and a summary of those impacts is provided in table 4-41. As described in section 2.3, Alternatives 3 and 4 were considered in the initial phase of this EIS, but were eliminated from further analysis because they were not feasible or were not substantially different from other analyzed alternatives, respectively.

Table 2-4. Comparison of Additional Coal Production, Surface Disturbance, Mine Life, and Revenues under the Proposed Action and Alternatives

Item	Existing Buckskin Mine Permit Area	Additional Under Alternative 1 (No Action)	Additional Under Proposed Action[1,3]	Additional Under Alternative 2[2,3]
In-Place Coal (as of 12-31-08)	460.9 mmt	0	77.2 mmt	269.7 mmt
Mineable Coal (as of 12-31-08)[4]	361.9 mmt	0	60.1 mmt	166.3 mmt
Recoverable Coal (as of 12-31-08)[4,5]	344.3 mmt	0	54.1 mmt	149.7 mmt
Potential Lease Area	6,438.2 acres	0	419.04 acres	1,883.1 acres
Total Disturbance Area[6]	6,727.8 acres[7]	0	478 acres	618 acres
Permit Area[8]	8,011.5 acres	0	1,009 acres	2,191.6 acres
Average Annual Post-2008 Coal Production	25 mmt	0	0	0
Remaining Life of Mine (Post-2008)[9]	14 years	0	2 years	6 years
Average Number of Employees	338	0	0	0
Total Projected State and Local Revenues (Post-2008)[10,11]	$563.6 million	0	$90.6–$108.8 million	$250.2–$300.4 million
Total Projected Federal Revenues (Post-2008)[12]	$417.0 million	0	$69.2–$87.3 million	$191.0–$241.1 million

mmt = million tons

1 Numbers are based on the entire proposed tract, which includes a 182-acre overlap with the existing Buckskin Mine permit area; that overlap was not factored into calculations for coal reserves for the existing mine, but was included in total disturbance numbers for the existing mine.

2 Numbers were calculated based on the entire BLM study area, which includes a 436.5-acre overlap with the existing Buckskin Mine permit area; that overlap was not factored into calculations for coal reserves for the existing mine, but was included in total disturbance numbers for the existing mine.

3 Coal numbers assume mining of the entire proposed tract or BLM study area. Estimates for total disturbance include additional lands in a buffer outside of those areas within the general analysis area, excluding operationally limited lands west of both county roads and around the occupied residence.

4 Mineable and recoverable coal figures under the Proposed Action and Alternative 1 are maximum estimates and do not account for coal reserves that would not be mined beneath the occupied residence and associated 300-foot buffer zone, or the public road rights-of-way (Collins and McGee roads), their associated 100-foot buffer zones, and other operationally limited lands between the two roads.

5 Recoverable coal figures assume a recovery rate of 95% for coal in the Canyon seam and a 90% for all other coal reserves; they do not include coal left behind as support pillars and similar structures, or unavoidably lost through spillage and spontaneous natural fires during normal mining operations.

6 The total area to be disturbed exceeds the leased area under the existing Buckskin Mine and the Proposed Action because of the need for highwall reduction, topsoil removal, and other mine support activities that cause surface disturbance outside the lease boundaries. The permit area is larger than the leased or disturbed area to ensure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description. The total area to be disturbed does not include lands under public roads, in their rights-of-way or 100-foot buffer zones, in the 300-foot buffer zone around the occupied residence, or in the operationally limited lands west of the Collins and McGee roads; those expected exclusions result in a smaller disturbance area than lease area under Alternative 2.

7 Includes federal and state coal leases currently held by the Buckskin Mining Company.

8 Pending WDEQ permit revision under the Proposed Action and Alternative 2.

9 Assumes average current average annual coal production rate of 25 million tons continues through life-of-mine.

10 Revenues to the State of Wyoming and local governments include severance taxes; property and production taxes (ad valorem); sales and use taxes; and Wyoming's share of federal royalty payments, bonus bids, annual rental payments, and Abandoned Mine Land fees. State revenues are based on an assumed price of $7.85 per ton of "recoverable coal," federal royalty of 12.5% of the value less 51% federal share, plus $0.315 per ton for Abandoned Mine Land fees on assumed 25% state share, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal per ton (based on average of six LBAs in 2004 and 2005) times the tonnage of recoverable coal times a 50% state share, plus $0.07 per ton estimated sales and use taxes, plus $0.33 per ton estimate for ad valorem taxes, plus $0.415 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered (i.e., taxes generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included. These figures could change based on the outcome of recent legislation that changed the percentage of distribution to states.

11 Revenues for Alternative 1 do not include the $4.2 million in scheduled coal lease bonus bids to be paid on the final tract configuration in fiscal year 2009.

12 Federal revenues are based on an assumed price of $7.85 per ton, federal royalty of 12.5% times 51% share, plus $0.315 per ton for Abandoned Mine Land fees times an assumed 75% federal share, plus black lung tax of $0.00261 per ton, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal (based on the range of the six LBA sales in 2004 and 2005) times tonnage of recoverable coal minus a 50% federal share. These figures could change based on the outcome of recent legislation that changed the percentage of distribution to states.

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3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (existing conditions) and analyzes the environmental consequences (potential direct and indirect impacts) on various resources in the general analysis area resulting from the Proposed Action and alternatives. The Proposed Action and alternatives (including the No Action Alternative) are described in chapter 2.

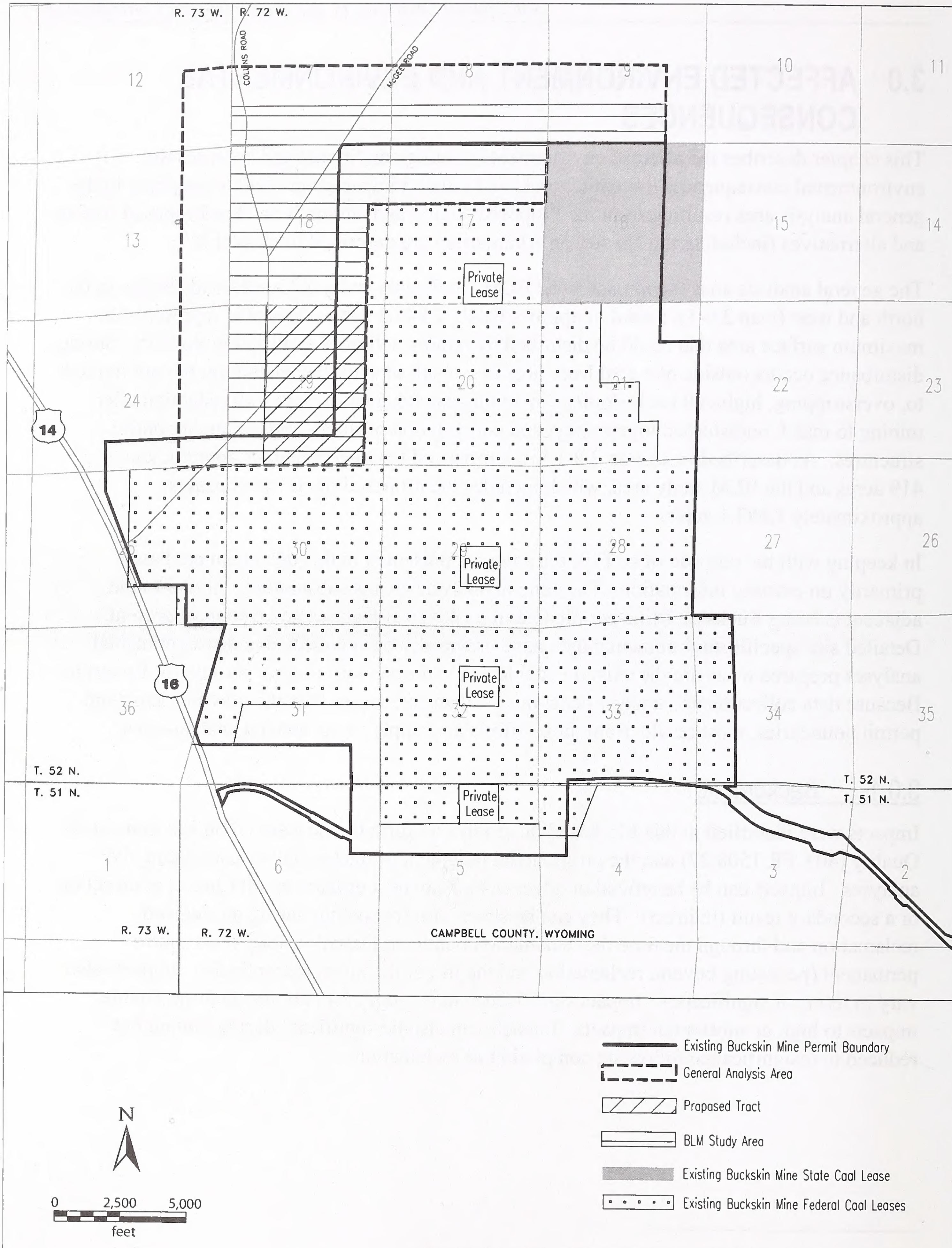
The general analysis area encompasses the BLM[1] study area and a 0.25-mile-wide buffer to the north and west (map 3.0-1), a total of approximately 2,847.3 acres. This area represents the maximum surface area that could be disturbed by mining activities analyzed in this EIS. Surface disturbance occurs outside of a coal lease area as a result of activities including, but not limited to, overstripping, highwall back-sloping (including catch benches), highwall reduction after mining to match undisturbed topography, and construction of flood- and sediment-control structures. As described in section 2.2.1.1, the proposed tract encompasses approximately 419 acres and the BLM study area, which includes the proposed tract, encompasses approximately 1,883.1 acres.

In keeping with the purpose of an EIS, the analyses presented in this document are based primarily on existing information. The general analysis area is substantially similar to the adjacent existing Buckskin Mine permit area in its physical features and resources present. Detailed site-specific environmental data have previously been collected and environmental analyses prepared to secure the existing coal leases and necessary mining permits for Buckskin. Because data collection and analyses encompassed an area larger than the previous lease and permit boundaries, most results from those efforts also apply to the general analysis area.

3.0.1 Background

Impacts were identified in this EIS based on criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists completing the analyses. Impacts can be beneficial or adverse, and can be a primary result (direct) of an action or a secondary result (indirect). They can be short-term (persisting during mining and reclamation and through the time the reclamation bond is released) or long-term and/or permanent (persisting beyond reclamation and the life of the mine, respectively). Impacts also vary in terms of significance. Impact significance may range from no impact or negligible impacts to high or substantial impacts. Impacts can also be significant during mining but reduced to insignificance following completion of reclamation.

[1] Refer to page xiii for a list of abbreviations and acronyms used in this document.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.0-1
General Analysis Area

3.0.2 Resources Analyzed in this EIS

Resources addressed in this chapter were identified during the scoping process or by an interdisciplinary team review as having the potential to be affected. The BLM requires that certain elements are analyzed when present in the affected environment. The following required elements are present in the general analysis area and are addressed in this EIS:

- air quality (section 3.4);
- water quality (section 3.5);
- wetlands/riparian zones (section 3.7);
- invasive non-native species (section 3.9);
- threatened and endangered species (sections 3.9 and 3.10);
- cultural resources (section 3.12);
- hazardous or solid wastes (section 3.16);
- Native American religious concerns (section 3.17); and
- environmental justice (section 3.17).

The following additional resources also are present in the general analysis area and are addressed in this EIS:

- topography and physiography (section 3.2);
- geology, mineral, and paleontological resources (section 3.3);
- other water resources (section 3.5);
- alluvial valley floors (section 3.6);
- soils (section 3.8);
- vegetation (section 3.9);
- wildlife (section 3.10);
- land use and recreation (section 3.11);
- visual resources (section 3.13);
- noise (section 3.14);
- transportation resources (section 3.15); and
- socioeconomics (section 3.17).

Five additional aspects considered in this chapter are:

- regulatory compliance;
- mitigation and monitoring;

- residual impacts;
- the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity; and
- any irreversible and irretrievable commitments of resources that would be associated with the action alternatives (42 United States Code § 4332[C]).

The following elements, which are required by the BLM when present in the affected environment, are not present in the general analysis area and are, therefore, not addressed in this EIS:

- areas of critical environmental concern;
- prime or unique farmlands;
- floodplains;
- wild and scenic rivers; and
- wilderness.

Individual data reports have been prepared for most resources to provide additional detailed information on the affected environment for the proposed tract and general analysis area. Copies of those reports can be viewed at the BLM Wyoming High Plains District Office in Casper, Wyoming.

As discussed in chapter 2, regulatory compliance, mitigation, and monitoring required by federal and/or state law are considered to be part of the action alternatives and are described for each resource area.

3.0.3 Summary of Mine Disturbance Area and Impacts

Table 3.0-1 provides comparisons of leased and disturbance acreages under the Proposed Action and alternatives. As described in section 3.0, additional disturbance beyond the respective lease boundaries is associated with overstripping and other activities necessary to recover the coal. The numbers presented for Alternative 1 are based on the overlap between the general analysis area and the existing permit boundary (map 3.0-1). Under this alternative, impacts analyzed for this overlap area would result from surface disturbance associated with the recovery of federal coal reserves under existing adjacent leases. Table 1-3 provides a breakdown of the total disturbed and reclaimed acreages for the entire existing Buckskin Mine permit area through December 2008.

Table 3.0-1. Comparisons of Disturbance Acres[1] and Estimated Recoverable Coal Reserves under the Proposed Action and Alternatives in the General Analysis Area and at the Buckskin Mine

	Alternative 1[2] (No Action)	Proposed Action	Alternative 2
Additional Coal Lease Area (Acres)	0	419.0	1,883.1
Total Potential Coal Lease Area (Acres) for the Mine[3]	6,438.2	6,857.2	8,321.3
% Increase in Potential Coal Lease Area (Acres) for the Mine	0	6.51	29.2
Estimated Potential Additional Disturbance Area (Acres)[4]	0	1,009.0[5]	2,191.6[5]
Estimated Expected Additional Disturbance Area (Acres)[4]	0	478.0[6]	618.0[6]
Estimated Potential Total Mine Disturbance Area (Acres)[4]	8,011.5[5]	9,020.5[5]	10,203.1[5]
Estimated Expected Total Mine Disturbance Area (Acres)[4]	6,727.8[6]	7,205.8[6]	7,345.8[6]
% Increase in Estimated Expected Disturbance Area (Acres)	0	7.1	9.2
Estimated Additional Recoverable Coal (million tons)[7]	0	54.1[6]	149.7[6]
Estimated Recoverable Coal for Mine as of 12/31/08 (million tons)[7]	344.3[6]	398.4[6]	494.0[6]
% Increase in Estimated Recoverable Coal as of 12/31/08	0	15.7	43.5

1 Acreages are rounded to the nearest tenth.

2 Under any alternative, potential surface disturbance could occur in the overlap between the general analysis area and the Buckskin Mine permit area (656 acres, map 3.0-1) to access previously permitted adjacent coal reserves. Approximately 182 acres of the proposed tract and 436.5 acres of the BLM study area are within the overlap area.

3 Includes federal and state coal leases held by the Buckskin Mine.

4 Estimated additional mine disturbance area = coal lease to be mined + associated surface disturbance necessary to access and process coal reserves (e.g., mine facilities, access roads, haul roads, topsoil stripping, highwall reduction, stockpiles).

5 Represents disturbance in the existing or anticipated permit area under each alternative, which would be the actual limit of potential surface disturbance.

6 Estimated expected additional and total mine disturbance areas, and estimated recoverable coal figures exclude lands under public roads, in their rights-of-way or 100-foot-wide buffer zones, in the 300-foot-wide buffer zone around the occupied residence, or in the operationally limited lands west of the Collins and McGee roads. Exact boundaries are presently undetermined.

7 Estimated recoverable coal resources = tons of mineable coal x recovery factor, and excludes all losses (spillage, spontaneous fires) that occur during normal mining operations. Recoverable coal figures assume all recoverable coal (except Canyon) has a recovery rate assumption of 90%. Canyon has a recovery rate assumption of 95%.

Table 3.0-2 presents a comparative summary of the direct and indirect environmental impacts under the Proposed Action and alternatives. Table 4-41 presents the same summary for the cumulative effects under each option. These impacts are analyzed in greater detail in chapter 3 and chapter 4, respectively.

Table 3.0-2. Summary Comparison of Magnitude[1] and Duration[2] of Direct and Indirect Impacts in the General Analysis Area under the Proposed Action and Alternatives[3]

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
3.2 Topography and Physiography			
Lower surface elevation	No impact	Moderate, permanent on 419 acres	Moderate, permanent on up to 1,883 acres
Permanent topographic moderation, which could result in:			
▪ Microhabitat reduction	Minor to moderate, long-term	Minor to moderate, long-term on 478 acres; no impact on rough breaks	Minor to moderate, long-term on up to 2,847 acres
▪ Habitat diversity reduction	Minor to moderate, long-term	Minor to moderate, long-term on 478 acres	Minor to moderate, long-term on up to 2,847 acres
▪ Big game carrying capacity reduction	Minor, short-term	Minor, short-term on 478 acres	Minor, short-term on up to 2,847 acres
▪ Reduction in water runoff and peak flows	Moderate, beneficial, long-term	Minor to moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Increased precipitation infiltration	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Reduction in erosion	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Potential enhanced vegetative productivity	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Potential acceleration of groundwater recharge	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
3.3 Geology and Minerals			
Removal of coal	No impact	Moderate, permanent on 419 acres	Moderate, permanent on up to 1,883 acres
Removal and replacement of topsoil and overburden	Moderate, permanent	Moderate, permanent on 478 acres	Moderate, permanent on up to 2,847 acres
Physical characteristic alterations in replaced overburden	No impact	Moderate, permanent on 419 acres	Moderate, permanent on up to 1,883 acres

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Loss of unrecovered CBNG through venting and/or depletion of hydrostatic pressure	No impact	Moderate to substantial, permanent on 419 acres	Moderate to substantial, permanent on up to 1,883 acres
Loss of access for development of sub-coal conventional oil and gas resources and other minerals/loss of resources	Minor, short-term on access; minor permanent on scoria resources; no impacts on uranium or bentonite	Moderate, short-term on access to 419 acres; minor, short-term on access to 59 surface acres; no impacts on scoria, uranium, or bentonite resources	Moderate, short-term on access to up to 1,883 acres; minor, short-term on access to up to 964 surface acres; minor, permanent on scoria resources; no impacts on uranium, or bentonite resources
Destruction of paleontological resources that are not exposed on the surface	Moderate to high, permanent	Moderate to high, permanent on 478 acres	Moderate to high, permanent on up to 2,847 acres
3.4 AIR QUALITY			
Particulate emissions:			
▪ Elevated concentrations associated with projected average production rate of 25 mmt per year in compliance with ambient standards	Moderate, adverse short-term for current life-of-mine estimate (14 years); no projected increase or exceedances	Moderate, adverse short-term for 2 years beyond current life-of-mine estimate; no projected increase in currently approved mining operations; no projected exceedances	Moderate, adverse short-term for up to 6 years beyond current life-of-mine estimate; no projected increase in currently approved mining operations; no projected exceedances
▪ Potential for public exposure to particulate emissions along U.S. Highway 14-16, various county roads, and occupied dwellings in the area	Minor, short-term for most residences for current life-of-mine estimate (14 years); highway and county roads average 0.5 mile away; moderate for one occupied residence within 0.5 mile; high for one occupied residence within 0.25 mile	Minor, short-term for most residences for 2 years beyond current life-of-mine estimate; highway is ≥1 mile away; county road adjacent for 0.6 mile stretch; nearest occupied home > 0.5 mile away	Minor to moderate, short-term for most residences for up to 6 years beyond current life-of-mine estimate; highway is ≥0.5 mile away; two county roads pass through area; moderate for one occupied residence within 0.25 mile; high for one occupied residence within general analysis area
▪ Potential for human health impacts as a result of exposure to particulate emissions	Minor, short-term for current life-of-mine estimate (14 years); no projected increase or exceedances	Low to minor, short-term for 2 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations	Minor to moderate, short-term for up to 6 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations;
NO_x emissions from machinery:			
▪ Elevated concentrations associated with average production of 25 mmt per year in compliance with ambient standards	Minor to moderate, adverse short-term for current life-of-mine estimate (14 years); no NO_x point sources at Buckskin; no projected increase or exceedances	Minor to moderate, adverse short-term for 2 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no projected increase in currently approved mining operations, no projected exceedances	Minor to moderate,adverse short-term for up to 6 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no projected increase in currently approved mining operations, no projected exceedances

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
▪ Potential for public exposure along U.S. Highway 14-16, various county roads, and occupied dwellings in the area	Minor to high, short-term for most residences for current life-of-mine estimate (14 years); no NO_x point sources at Buckskin; highway and county roads average 0.5 mile away; moderate, short-term for one occupied residence within 0.5 mile; high, short-term for one occupied residence within 0.25 mile	Minor to moderate, short-term for most residences for 2 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no projected increase in currently approved mining operations, no projected exceedances; highway is ≥1 mile away; county road adjacent for 0.6 mile stretch; nearest occupied home > 0.5 mile away	Minor to high, short-term for most residences for up to 6 years beyond current life-of-mine estimate; No NO_x point sources at Buckskin; no projected increase in currently approved mining operations, no projected exceedances; highway is ≥0.5 mile away; two county roads pass through area; moderate for one occupied residence within 0.25 mile; high for one occupied residence within general analysis area
▪ Potential for human health impacts as a result of exposure	Minor, short-term for current life-of-mine estimate (14 years); no NO_x point sources at Buckskin; no projected increase or exceedances	Minor, short-term for 2 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no projected increase or exceedances in currently approved mining operations	Minor to moderate, short-term for up to 6 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no projected increase or exceedances in currently approved mining operations
NO_x emissions from blasting (in compliance with Buckskin Mine permit blasting conditions):			
▪ Elevated concentrations associated with average production of 25 mmt per year in compliance with ambient standards	No impact	Low, short-term for 2 years beyond current life-of-mine estimate; no reported events; no projected increase in currently approved mining operations or projected exceedances	Low, short-term for up to 6 years beyond current life-of-mine estimate; no reported events; no projected increase in currently approved mining operations or projected exceedances
▪ Potential for public exposure along U.S. Highway 14-16, various county roads, and occupied dwellings in the area	No impact	Low, short-term for 2 years beyond current life-of-mine estimate; no reported or projected events; highway is ≥1 mile away; county road adjacent for 0.6 mile stretch; nearest occupied home > 0.5 mile away	Low, short-term for up to 6 years beyond current life-of-mine estimate; no reported or projected events; highway is ≥0.5 mile away; two county roads pass through area; minor for one occupied residence within 0.25 mile and one within general analysis area
▪ Potential for human health impacts as a result of exposure	No impact	Low, short-term for 2 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations	Low to minor, short-term for up to 6 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Visibility:			
▪ Elevated concentrations of fine particulate matter associated with average production rate of 25 mmt per year	Low, short-term for current life-of-mine estimate (14 years); no projected increase or exceedances; no changes in current VRM class; no visual resources unique to area present	Low, short-term for 2 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations; no projected changes in current VRM class; no visual resources unique to area present	Low, short-term for up to 6 years beyond current life-of-mine estimate; no projected increase or exceedances in currently approved mining operations; no projected changes in current VRM class; no visual resources unique to area present
Acidification of lakes:			
▪ NO_2 emissions from mining coal at Buckskin	Very low, short-term for current life-of-mine estimate (14 years); no NO_x point sources at Buckskin; no sensitive lakes in vicinity	Very low, short-term for 2 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no sensitive lakes in vicinity	Very low for up to 6 years beyond current life-of-mine estimate; no NO_x point sources at Buckskin; no sensitive lakes in vicinity
▪ SO_2 emissions derived from burning Buckskin Mine coal to produce power	Moderate, short term for current life-of-mine estimate (14 years) in vicinity of power plants; no sensitive lakes in vicinity	Moderate, short term in vicinity of power plants for 2 years beyond current life-of-mine estimate; No sensitive lakes in vicinity	Moderate, short term in vicinity of power plants for up to 6 years beyond current life-of-mine estimate; No sensitive lakes in vicinity
3.5 WATER RESOURCES			
Groundwater:			
▪ Removal of coal and overburden aquifers	No impact	Moderate, permanent on 419 acres	Moderate, permanent on up to 1,883 acres
▪ Replacement of existing coal and overburden with unconsolidated backfill material	No impact	Moderate, permanent on 419 acres	Moderate, permanent on up to 1,883 acres
▪ Depressed water levels in overburden and coal aquifers adjacent to mine	No impact	Moderate, short- to long-term for 2 years beyond current life-of-mine estimate	Moderate, short- to long-term for up to 6 years beyond current life-of-mine estimate
▪ Change in hydraulic properties in backfilled areas	No impact	Low, long-term to permanent for 2 years beyond current life-of-mine estimate	Low, long-term to permanent for up to 6 years beyond current life-of-mine estimate
▪ Increase in total dissolved solids concentrations in backfilled areas	No impact	Moderate, long-term for 2 years beyond current life-of-mine estimate	Moderate, long-term for up to 6 years beyond current life-of-mine estimate
▪ Use of subcoal aquifers for water supply	No impact	Negligible, short-term for 2 years beyond current life-of-mine estimate	Negligible, short-term for up to 6 years beyond current life-of-mine estimate
▪ Decrease in water supply for groundwater-right holders within the 5-foot drawdown area	No impact	Moderate, permanent	Moderate, permanent

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Surface water:			
▪ Diversion and disruption of surface drainage systems	Significant temporary; moderate, short-term for current life-of-mine estimate (14 years)	Significant temporary on 478 acres; moderate, short-term on surface drainage for 2 years beyond current life-of-mine estimate; no channel diversions	Significant temporary on up to 2,847 acres; moderate, short-term on surface drainage for up to 6 years beyond current life-of-mine estimate; no channel diversions expected
▪ Reconstruction of surface drainage systems	Permanent	Permanent on 478 acres	Permanent on up to 2,847 acres
▪ Increased runoff and erosion rates on disturbed lands due to vegetation removal	Significant, temporary; minor to moderate short-term due to use of flood- and erosion-control structures and reseeding	Significant, temporary on 478 acres; minor to moderate short-term due to use of flood- and erosion-control structures and reseeding	Significant, temporary on up to 2,847 acres; minor to moderate, short-term due to use of flood- and erosion-control structures and reseeding
▪ Increased infiltration on reclaimed lands due to topographic moderation	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Increased runoff on reclaimed lands due to loss of soil structure	Moderate, long-term	Moderate, long-term on 478 acres	Moderate, long-term on up to 2,847 acres
▪ Potential for adverse downstream effects as a result of sediment produced by large storms	Moderate, long-term	Minor, long-term on 478 acres; no connected drainages	Moderate, long-term on up to 2,847 acres
Water rights:			
▪ Disruption of water supply for water-rights holders with wells completed in the coal or overburden aquifer within the 5-foot drawdown area or with surface water rights within the disturbance area	Moderate, adverse long-term for wells until recharge/moderate, adverse long-term for current life-of-mine estimate (14 years); up to two surface water rights	Moderate, adverse long-term for wells until recharge/minor, adverse long-term for one surface water right; no connected drainages; impacts for 2 years beyond current life-of-mine estimate	Moderate, adverse long-term for wells until recharge/moderate, adverse long-term for up to two surface water rights and up to 6 years beyond current life-of-mine estimate , no new creek diversions
3.6 Alluvial Valley Floors			
Removal and restoration of AVFs	No impact	No impact	No impact
Disruptions to streamflows supplying downstream AVFs	No impact; stream diversions constructed for existing approved mining operations maintain streamflow	No impact; closed drainage prevents streamflow	No impact; stream diversions constructed to maintain streamflow

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
3.7 Wetlands			
Removal of jurisdictional wetlands and loss of wetland function until reclamation occurs	Moderate, short-term for current life-of-mine estimate (14 years); 2 potential jurisdictional wetlands	Minor, short-term on 478 acres for 2 years beyond current life-of-mine estimate; 2 potential jurisdictional wetlands, total of 0.48 acre; no net loss	Moderate, short-term on up to 2,847 acres for up to 6 years beyond current life-of-mine estimate; up to 12 potential jurisdictional wetlands, total of 30.7 acres; no net loss
Removal of nonjurisdictional wetlands	Moderate, short- to long-term; 1 nonjurisdictional wetland	No impact	Moderate, short- to long-term on up to 2,847 acres; 6 nonjurisdictional wetlands
3.8 Soils			
Changes in physical properties after reclamation would include:			
▪ Increased near surface bulk density and decreased soil infiltration rate resulting in increased potential for soil erosion	Moderate, long-term	Moderate, long-term on 478 acres	Moderate, long-term on up to 2,847 acres
▪ More uniformity in soil type, thickness, and texture	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
▪ Decreased runoff due to topographic modification	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres
Changes in biological properties in soils that are stockpiled before reclamation would include:			
▪ Reduction in organic matter	Moderate, short- to long-term	Moderate, long-term on 478 acres	Moderate, long-term on up to 2,847 acres
▪ Reduction in microorganism population	Moderate, short- to long-term	Moderate, long-term on 478 acres	Moderate, long-term on up to 2,847 acres
▪ Reduction in seeds, bulbs, rhizomes, and live plant parts	Moderate, short- to long-term	Moderate, long-term on 478 acres	Moderate, long-term on up to 2,847 acres
Changes in chemical properties would include:			
▪ More uniform soil nutrient distribution	Moderate, beneficial, long-term	Moderate, beneficial, long-term on 478 acres	Moderate, beneficial, long-term on up to 2,847 acres

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
3.9 Vegetation			
During mining:			
▪ Progressive removal of existing vegetation	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
▪ Increased erosion	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
▪ Wildlife habitat and livestock grazing loss	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
After revegetation:			
▪ Changes in vegetation patterns	Negligible, long-term	Negligible, long-term on 478 acres	Negligible, long-term on up to 2,847 acres
▪ Reduction in vegetation diversity	Negligible, long-term	Negligible, long-term on 478 acres	Negligible, long-term on up to 2,847 acres
▪ Reduction in shrub density	Minor, long-term; shrubs less than 11% composition	Minor, long-term on 478 acres; shrubs less than 11% composition	Minor, long-term on up to 2,847 acres; shrubs less than 11% composition
▪ Decreased big game habitat carrying capacity	Low, long-term	Low, long-term on 478 acres	Low, long-term on up to 2,847 acres
▪ Decreased habitat for shrub dependent species	Minor, long-term; shrubs less than 11% composition	Minor, long-term on 478 acres; shrubs less than 11% composition	Minor, long-term on up to 2,847 acres; shrubs less than 11% composition
▪ Potential invasion of non-native plant species	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
3.10 Wildlife			
Big game displacement from active mining areas	Moderate, short-term	Moderate, short-term on 478 acres for 2 years beyond current life-of-mine estimate	Moderate, short-term on up to 2,847 acres for up to 6 years beyond current life-of-mine estimate
Increased competition on adjacent undisturbed or reclaimed lands, especially big game	Moderate, short-term for current life-of-mine estimate (14 years)	Moderate, short-term for 2 years beyond current life-of-mine estimate	Moderate, short-term for up to 6 years beyond current life-of-mine estimate
Restriction of wildlife movement, especially big game	Moderate, short-term for current life-of-mine estimate (14 years)	Moderate, short-term on 478 acres for 2 years beyond current life-of-mine estimate	Moderate, short-term on up to 2,847 acres for up to 6 years beyond current life-of-mine estimate

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Increased mortality of small mammals	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
Displacement of small and medium-sized mammals	Moderate, short-term for current life-of-mine estimate (14 years)	Moderate, short-term on 478 acres for 2 years beyond current life-of-mine estimate	Moderate, short-term on up to 2,847 acres for up to 6 years beyond current life-of-mine estimate
Surface and noise disturbance of occupied sage-grouse leks	No surface impact, minor noise impact, short-term for current life-of-mine estimate (14 years); 1 sage-grouse lek within 0.5 mile; last active in 2001, confirmed inactive in 13 of last 14 years	No impact; no sage-grouse leks on or within1.5 mile	No surface impact, minor noise impact, short-term for up to 6 years beyond current life-of-mine estimate; 1 sage-grouse lek within 0.5 mile; last active in 2001, confirmed inactive in 13 of last 14 years
Disturbance of potential sage-grouse nesting habitat during mining	Minor, short-term; shrubs less than 11% composition	Minor, short-term on 478 acres; shrubs less than 11% composition	Minor, short-term on up to 2,847 acres; shrubs less than 11% composition
Loss of sage-grouse nesting habitat after reclamation	Minor, long-term; long shrub restoration process	Minor, long-term on 478 acres; long shrub restoration process	Minor, long-term on up to 2,847 acres; long shrub restoration process
Alteration of plant and animal communities after reclamation	Negligible, short-term	Negligible, short-term on 478 acres	Negligible, short-term on up to 2,847 acres
Abandonment of raptor nests	Low, short-term; 1 intact nest present; nest trees scheduled for eventual disturbance; USFWS approved mitigation plan in place to protect active nests; pair documented as acclimated to disturbance	Low, short-term; 1 intact nest present; nest trees scheduled for eventual disturbance under No Action Alternative; USFWS approved mitigation plan will be updated to protect active nests; pair documented as acclimated to disturbance	Low, short-term; 3 intact nests present; nest trees at one site scheduled for eventual disturbance, other two sites in residential shelterbelts not scheduled for disturbance; USFWS approved mitigation plan will be updated to protect active nests; pairs documented as acclimated to disturbance
Loss of foraging habitat for raptors	Negligible, short-term	Negligible, short-term on 478 acres	Negligible, short-term on up to 2,847 acres
Loss of nesting, roosting, and foraging habitat for Migratory Bird Species of Management Concern (including the bald eagle)	Negligible, short-term	Negligible, short-term on 478 acres	Negligible, short-term on up to 2,847 acres
Reduction in waterfowl nesting and feeding habitat	Negligible, short-term; few water bodies present, ephemeral or limited seasonal presence	Negligible, short-term on 478 acres; few water bodies present, ephemeral or limited seasonal presence	Negligible, short-term on up to 2,847 acres; few water bodies present, ephemeral or limited seasonal presence

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Loss of habitat for aquatic species during mining	Negligible, short-term; few water bodies present, ephemeral or limited seasonal presence	Negligible, short-term on 478 acres; few water bodies present, ephemeral or limited seasonal presence	Negligible, short-term on up to 2,847 acres; few water bodies present, ephemeral or limited seasonal presence
Road kills by mine-related traffic	Minor, short-term	Minor, short-term on 478 acres	Minor, short-term on up to 2,847 acres
Reduction in habitat carrying capacity and habitat diversity on reclaimed lands	Minor, short-term	Minor, short-term on 478 acres	Minor, short-term on up to 2,847 acres
Potential reduction in microhabitats on reclaimed lands	Minor to moderate, long-term	Minor to moderate, long-term on 478 acres	Minor to moderate, long-term on up to 2,847 acres
Threatened, Endangered, Proposed, And Candidate Species (Appendix I)			
Black-footed ferret	No effect	No effect	No effect
Blowout penstemon	No effect	No effect	No effect
Ute ladies'-tresses	No effect	No effect	No effect
3.11 Land Use and Recreation			
Reduction of livestock grazing	Minor, short-term	Minor, short-term on 478 acres	Minor, short-term on up to 2,847 acres
Loss of wildlife habitat	Minor to moderate, short-term	Minor to moderate, short-term on 478 acres	Minor to moderate, short-term on up to 2,847 acres
Loss of access for sub-coal oil and gas development	Minor, short-term for access	Moderate, short-term for access on 419 acres; minor, short-term for access on 59 surface acres	Moderate, short-term for access on up to 1,883 acres; minor, short-term for access on up to 964 surface acres
Removal of oil and gas production facilities	Moderate, short-term; no conventional oil and gas production	Moderate, short-term on 478 acres; no conventional oil and gas production	Moderate, short-term for access on up to 2,847 acres; no conventional oil and gas production
Loss of access to public land available for recreation and grazing	No impact; entirely private	No impact; entirely private surface	No impact; entirely private surface

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
3.12 Cultural Resources and Native American Consultation			
Cultural Resources			
▪ Sites that are not eligible for NRHP	Ineligible sites in existing approved mining operations may be destroyed without protection or further work	Ineligible sites on 478 acres may be destroyed without protection or further work	Ineligible sites on up to 2,847 acres may be destroyed without protection or further work
▪ Sites that are eligible for NRHP	No known sites; impacts on eligible sites discovered during operations would be avoided or mitigated through data recovery prior to mining	No known sites on 478 acres; impacts on eligible sites discovered during operations would be avoided or mitigated through data recovery prior to mining	No known sites on entire 2,847 acres; impacts on eligible sites discovered during operations would be avoided or mitigated through data recovery prior to mining
▪ Sites that are unevaluated for NRHP eligibility	No known unevaluated sites; impacts on unevaluated sites are not permitted; unevaluated sites would be evaluated prior to mining	No known unevaluated sites on 478 acres; impacts on eligible sites discovered during operations would be avoided or mitigated through data recovery prior to mining	No known unevaluated sites on entire 2,847 acres; impacts on eligible sites discovered during operations would be avoided or mitigated through data recovery prior to mining
Native American Heritage Sites	No impact identified	No impact identified on 478 acres	No impact identified on entire 2,847 acres
3.13 Visual Resources			
During mining:			
▪ Alteration of landscape by mining facilities and operations	Moderate, short-term	Moderate, short-term on 478 acres	Moderate, short-term on up to 2,847 acres
▪ Visibility of mining operations from highway	Moderate, short-term for current life-of-mine estimate (14 years); highway is 0.5 to 2.5 miles away	Low, short-term for 2 years beyond current life-of-mine estimate; highway is ≥1 mile away	Moderate, short-term for up to 6 years beyond current life-of-mine estimate; highway 0.5 to 1.5 miles away
Following reclamation:			
▪ Smoother sloped terrain	Minor to moderate, permanent	Minor, permanent on 478 acres; no rough breaks	Minor to moderate, permanent on up to 2,847 acres
▪ Reduction in sagebrush density	Minor, long-term; shrubs less than 11% composition	Minor, long-term on 478 acres; shrubs less than 11% composition	Minor, long-term on up to 2,847 acres; shrubs less than 11% composition

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
3.14 Noise			
Increased noise levels	No impact to high, short-term for current life-of-mine estimate (14 years); one occupied residence within 0.25 mile, most homes ≥1 mile away on far side of active roads or hills for audio buffer	No impact to moderate, short-term for 2 years beyond current life-of-mine estimate; 0.75 mile to nearest occupied residence; most homes on far side of active roads or hills for audio buffer	No impact to moderate, short-term for up to 6 years beyond current life-of-mine estimate; 1 mile to nearest occupied residence; most homes on far side of active roads or hills for audio buffer
3.15 Transportation Facilities			
Use of railroads to ship coal	Moderate, short-term for current life-of-mine estimate (14 years)	Moderate, short-term for 2 years beyond current life-of-mine estimate	Moderate, short-term for up to 6 years beyond current life-of-mine estimate
Employee and service contractor use of highways to and from mine sites	Moderate, short-term for current life-of-mine estimate (14 years)	Moderate, short-term for 2 years beyond current life-of-mine estimate	Moderate, short-term for up to 6 years beyond current life-of-mine estimate
Relocation of pipelines	No impact; all lines already addressed for current life-of-mine estimate (14 years)	Moderate, short-term for 2 years beyond currently life-of-mine estimate; 3 pipelines affected	Moderate, short-term for up to 6 years beyond currently life-of-mine estimate; 5 pipelines affected
Relocation of utility lines	Negligible, short-term; all or most lines already addressed for current life-of-mine estimate (14 years)	Low, short-term for 2 years beyond currently life-of-mine estimate; 2 overhead power lines affected, both within existing permit area	Minor, short-term for up to 6 years beyond currently life-of-mine estimate; 8 overhead power lines affected, 7 in existing permit area
Mining operations near the Collins and McGee roads	Minor, short-term for current life-of-mine estimate (14 years); no roads expected to be closed or relocated	Moderate, short-term for 2 years beyond currently life-of-mine estimate; 0.6 mile along 1 county road; no roads expected to be closed or relocated	Moderate, short-term for up to 6 years beyond currently life-of-mine estimate; approximately 3 miles along 2 county roads; no roads expected to be closed or relocated
3.16 Hazardous and Solid Waste			
Waste generated by mining operations	Negligible, short-term for current life-of-mine estimate (14 years)	Negligible, short-term for 2 years beyond current life-of-mine estimate	Negligible, short-term for up to 6 years beyond current life-of-mine estimate
3.17 Socioeconomics			
Employment	Negligible, beneficial, short-term for current life-of-mine estimate (14 years); no new hires expected	Negligible, beneficial, short-term for 2 years beyond current life-of-mine estimate; no new hires expected	Negligible, beneficial, short-term for up to 6 years beyond current life-of-mine estimate; no new hires expected

Description of Potential Impact by Resource	Magnitude and Duration of Impact		
	No Action Alternative[4]	Action Alternatives[5]	
	Alternative 1	Proposed Action	Alternative 2
Revenues from royalties and taxes to the state and local government	Substantial, beneficial short-term for current life-of-mine estimate (14 years)	Substantial, beneficial, short-term for 2 years beyond current life-of-mine estimate	Substantial, beneficial, short-term for up to 6 years beyond current life-of-mine estimate
Revenues from royalties and taxes to the federal government	Substantial, beneficial short-term for current life-of-mine estimate (14 years)	Substantial, beneficial, short-term for 2 years beyond current life-of-mine estimate	Substantial, beneficial, short-term for up to 6 years beyond current life-of-mine estimate
Economic development	Moderate, beneficial short-term for current life-of-mine estimate (14 years)	Moderate, beneficial, short-term for 2 years beyond current life-of-mine estimate	Moderate, beneficial, short-term for up to 6 years beyond current life-of-mine estimate
Additional housing and infrastructure needs	No new impact for current life-of-mine estimate (14 years)	No new impact for 2 years beyond current life-of-mine estimate	No new impact for up to 6 years beyond current life-of-mine estimate

mmt = million tons; NO_x = oxides of nitrogen; WDEQ/AQD = Wyoming Department of Environmental Quality/Air Quality Division; WDEQ/LQD = Wyoming Department of Environmental Quality/Land Quality Division; VRM = visual resource management; SO_2 = sulfur dioxide; AVF = alluvial valley floor; NRHP = National Register of Historic Places

1 Refer to sections 3.2 through 3.17 for discussions on magnitude of impacts for each resource under each alternative.

2 Short-term impacts persist during mining and reclamation and through the time the reclamation bond is released; long-term and/or permanent impacts persist beyond reclamation and the life of the mine, respectively.

3 All impacts are assumed adverse unless noted otherwise.

4 Impacts under the No Action Alternative apply to the overlap area between the general analysis area and the existing Buckskin Mine permit area. These impacts would be limited to surface disturbance associated with mine support (e.g., topsoil stripping) and reclamation activities (described in section 1.1.3.3 and section 1.1.3.4, respectively) for currently permitted mining in existing coal leases. These impacts would occur under the action alternatives, as well.

5 Kiewit estimates that actual physical disturbance from mining and mine support and reclamation activities would be 478 acres under the Proposed Action and 618 acres under Alternative 2. Those estimates assume that no roads would be closed or relocated and that surface disturbance would not encroach on the occupied residence and its 300-foot buffer. Mine support and reclamation activities (described in section 1.1.3.3 and section 1.1.3.4, respectively) would occur in a buffer area to the north of the proposed tract (under the Proposed Action) or 0.25-mile-wide buffer around the final tract configuration (under Alternative 2). The maximum potential disturbance area under Alternative 2, if Kiewit were to pursue road closures/relocations or surface rights for the occupied residence, would be approximately 2,847 acres. This area of maximum potential disturbance was analyzed in this EIS, and is referred to throughout as the general analysis area.

3.1 General Setting

This section provides an overview of the physical setting and climatic characteristics of the general analysis area and surrounding region.

3.1.1 General Location and Characteristics

The general analysis area is adjacent to one of the northern-most operating mines in the PRB, in the part of the Northern Great Plains that includes most of northeastern Wyoming. This region is also within the Great Plains Steppe and Shrub Province of the Dry Domain ecoregion of the continent (USDA Forest Service 2009). Ecoregions are comprised of large areas of similar climate where ecosystems are present in predictable patterns. The defining characteristic of a dry climate is that annual losses of water through evaporation at the earth's surface exceed annual water gains from precipitation. As a result of that overall water deficiency, no permanent streams originate in dry climate zones. The Dry Domain ecoregion is the most extensive in the world, and occupies one-quarter or more of the earth's land surface.

Wyoming has a relatively cool climate due to its elevation. Away from the mountains, the mean maximum temperatures in July range between 85 and 95° F and the mean minimum temperatures that month range from 50 to 60 ° F (National Oceanic and Atmospheric Administration 1985.). January is typically the coldest month, with minimum temperatures often ranging from 5 to 10°F. Early freezes in the fall and late in the spring are characteristic of the state, and result in long winters and short (average 125 days) growing seasons. Sunshine dominates the area, with approximately 60% of winter days and about 75% of summer days. Spring and summer are the wettest months, though rainfall amounts are highly variable and can be somewhat localized. Relative humidity ranges from 5 to 75%, depending on the season, with an average of 25 to 30% on the warmer summer days. Wyoming is quite windy, with frequent periods of wind speeds of 30 to 40 miles per hour in winter. Snow typically falls from November through May, with light to moderate levels at lower elevations. The low relative humidity, high percentage of sunshine, and higher average winds all contribute to a high rate of evaporation across the state.

The vegetation in the general analysis area consists of species common to eastern Wyoming and is consistent with vegetative communities in the adjacent Buckskin Mine permit area. The proposed tract is dominated (approximately 71%) by various upland grasslands. The general analysis area is comprised primarily of upland grasslands (approximately 40%) and agricultural lands (croplands and pastures, 31%). Section 3.9 provides a detailed discussion on vegetation resources.

3.1.2 Climate and Meteorology in the General Analysis Area

As indicated, the climate in the general analysis area is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature (figure 3.1-1). Summers are relatively short and warm, while winters are longer and cold. The average daily

mean temperature at the adjacent Buckskin Mine meteorological station from 1986 through 2007 was 46° Fahrenheit (F). The highest recorded temperature at the mine during that period was 106° F and the lowest was minus 33° F. July is the warmest month, with a mean daily temperature of 72° F, and January is the coldest month, with a mean daily temperature of 26° F. The frost-free period for this area lasts between 100 and 130 days (Curtis 2004).

Precipitation occurs predominantly during the spring and fall, with approximately 10% in the form of snow. The average annual precipitation measured at the National Oceanic and Atmospheric Administration meteorological station (Gillette 9ESE) located about 14 miles southeast of the Buckskin Mine was 15.67 inches (Western Regional Climate Center 2008). May (2.67 inches) and June (2.69 inches) are the wettest, while January (0.57 inch) and February (0.56 inch) are the driest. Snowfall averages 56.4 inches per year at the Gillette 9ESE station, with the highest monthly averages occurring in March (10.4 inches) and April (8.4 inches). In keeping with the Dry Domain ecoregion, evapo-transpiration, at approximately 31 inches of water per year, exceeds annual precipitation (National Oceanic and Atmospheric Administration 1969).

Surface wind speeds at the Buckskin Mine meteorological station average 10.5 miles per hour throughout the year. Prevailing winds are from the north-northwest and south-southeast directions (figure 3.1-2), depending on the season. The area experiences extreme wind gusts, especially during thunderstorm activity in June, July, and August. Distinct diurnal changes occur, with average wind velocities increasing during the day due to solar insolation, and decreasing during the night (figure 3.1-3). Local variations in wind speed and direction are primarily due to differences in topography. Wind speeds at the mine's meteorological station are highest in the winter and spring. From May through September, winds are calmer and directions are more random, although winds from the north or southeast still occur slightly more often than from other directions.

During periods of strong wind, dust may affect air quality across the region. Air quality can also be affected when air is trapped by poor ventilation due to persistent light or calm winds, and by the presence of inversions. Such episodes are referred to as air stagnation events (Wang and Angell 1999). An average of 15 air-stagnation events occurs annually in the PRB with an average duration of two days each (BLM 1974).

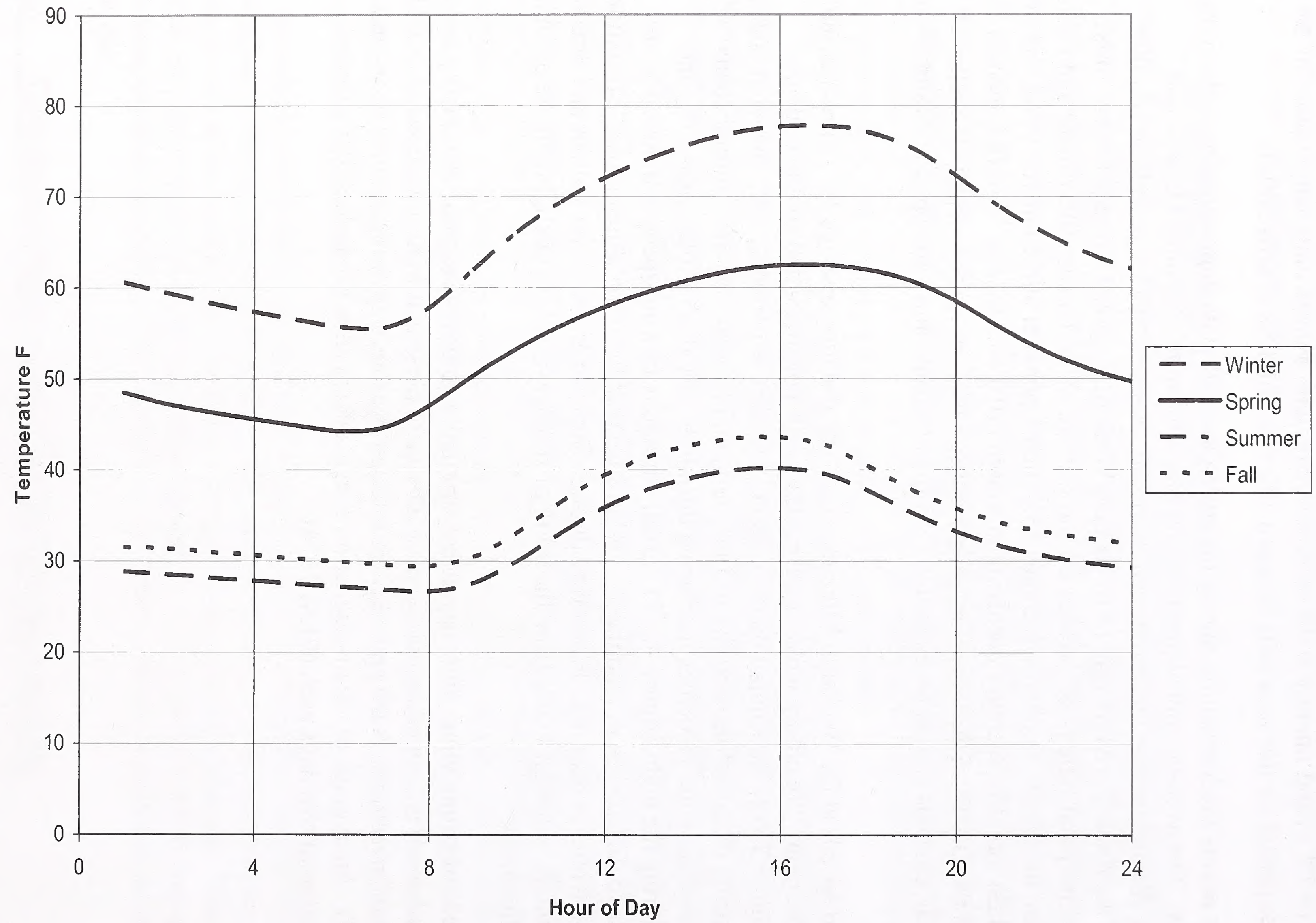
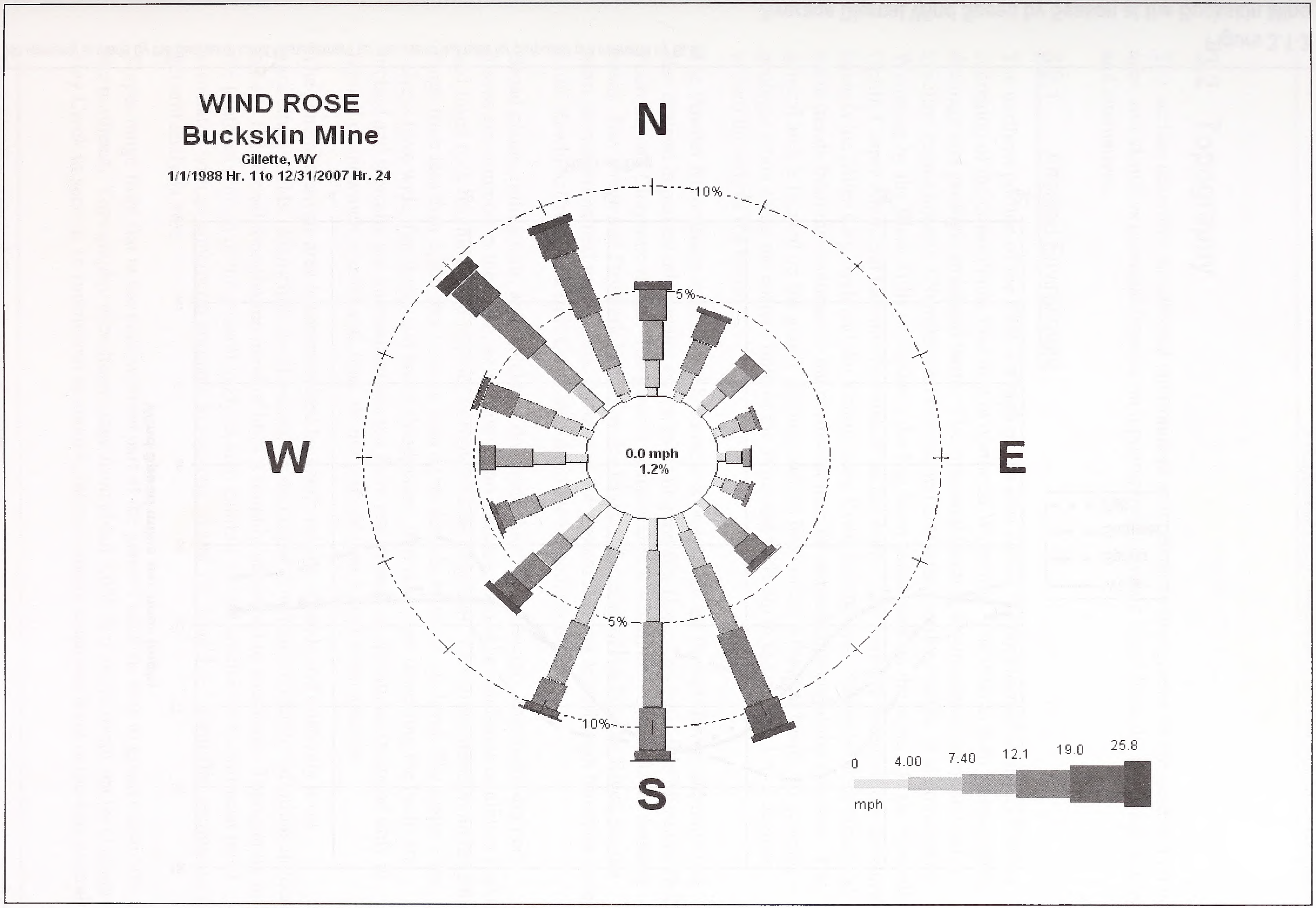
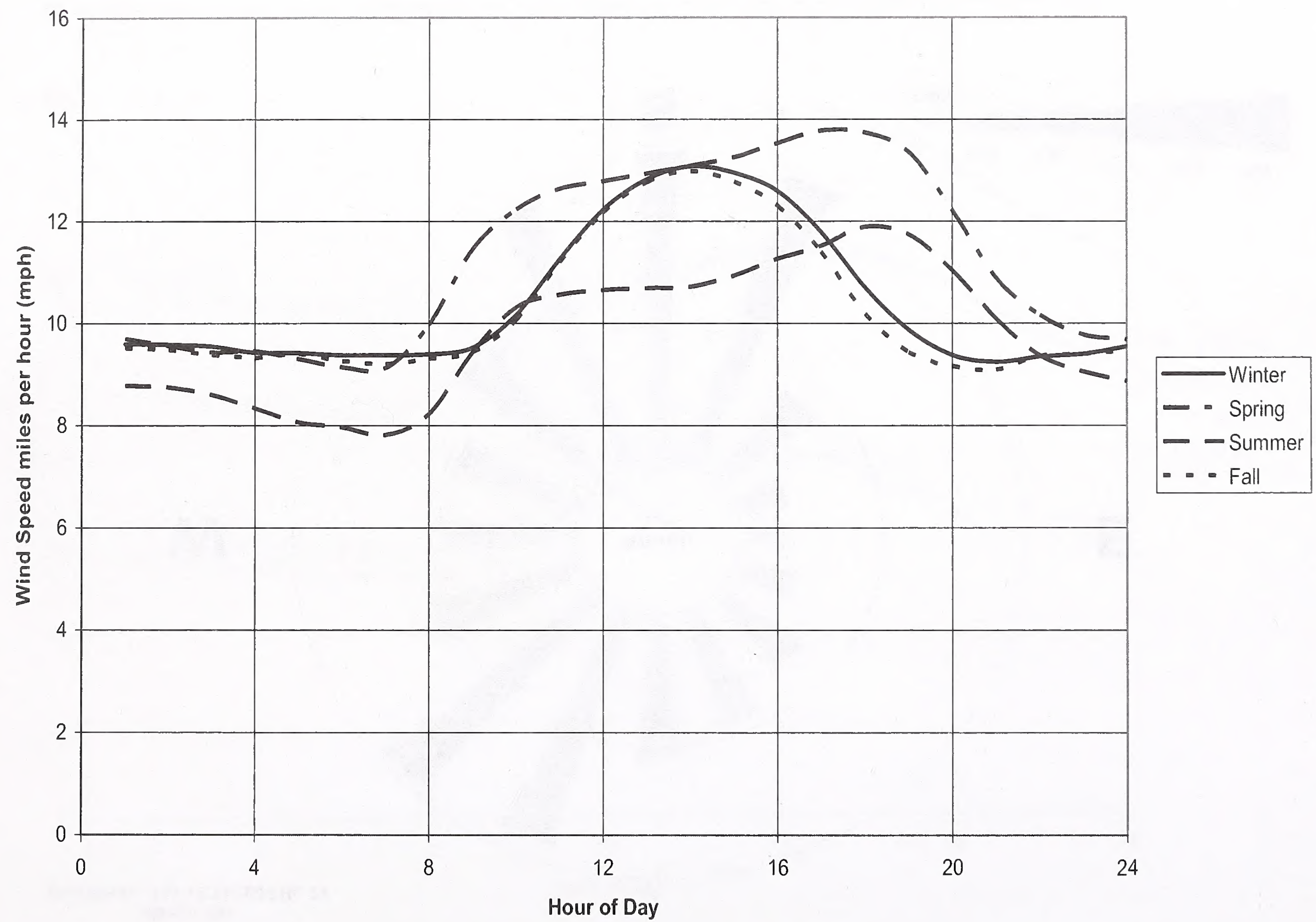


Figure 3.1-1
Average Diurnal Temperature by Season at Buckskin Mine



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.1-2
Wind Rose for the Buckskin Mine



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.1-3
Average Diurnal Wind Speed by Season at the Buckskin Mine

3.2 Topography

This section describes the affected environment as it relates to topography in the general analysis area, and identifies potential impacts on topography that would result from the Proposed Action and alternatives.

3.2.1 Affected Environment

The northern portion of the PRB is a high plains area within the unglaciated Missouri Plateau subregion of the Great Plains Province in northeast Wyoming. The PRB is both a topographic drainage and geologic structural basin. The structural basin is an elongated, asymmetrical syncline approximately 120 miles east to west and 200 miles north to south. It is bounded in Wyoming by the Black Hills on the east; the Big Horn Mountains on the west; and the Hartville Uplift, Casper Arch, and Laramie Mountains on the south. The northern extent of the structural basin is the Miles City Arch and the Yellowstone River in Montana. The axis of the structural basin trends from the southeast to the northwest near the western margin of the syncline. The general area is located on the gently dipping eastern limb of the structural basin. In general, geologic strata along the eastern limb of the structural PRB dip to the west at 1 to 2 degrees toward the axis of the basin.

The Powder River Basin is so named because it is drained by the Powder River, although it is also drained in part by other major rivers, including the Big Horn, Tongue, Little Missouri, Belle Fourche, and Cheyenne rivers. The general analysis area is within the Powder River drainage basin. Hay Creek and Dry Fork Little Powder River, tributaries of the Powder River, are the most prominent natural topographic features in the general analysis area, though Rawhide Creek, Little Rawhide Creek, and Calf Creek also drain the immediate area.

Broad plains, rolling hills, and tablelands dominate the PRB landscape. Internally-drained playas are common in the basin, as are buttes and plateaus capped by sandstone or clinker (baked and fused rock resulting from in-place burning of coal deposits). Elevations throughout the PRB range from less than 2,500 feet to more than 6,000 feet above mean sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the basin are incised and typically are intermittent (do not flow year-round) or ephemeral (respond only to rainfall or snowmelt events) and, thus, do not provide year-round water sources.

The general analysis area is characterized by gently rolling uplands and relatively level agricultural fields. Many hills are dissected by drainages that create moderate variations in local relief. The overall topographic trend of hills is roughly northwest to southeast. Topography in the southern portion of the general analysis area exhibits a local southwest-to-northeast trend associated with an ephemeral drainage in sections 18 and 19. Map 3.0-1 identifies sections in the general analysis area.

Slopes range from flat in the northwestern part of the general analysis area to greater than 30% in the northeast. Topographic elevations range from about 4,080 feet above mean sea level along Hay Creek in section 16 (northeast) to about 4,380 feet above mean sea level in the east-central

portion of section 19 (southwest). Local relief is greatest in sections 8 and 9 (north-northeast), where drainages deeply dissect the uplands and create relatively steep slopes and prominent bluffs of sandstone that are resistant to erosion. The flattest portion of the general analysis area is in the broad valley bottom of Hay Creek in the north-central portion of section 18. A topographic depression encompassing about 8.8 acres is located in the west-central portion of that section.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action

Under the Proposed Action, surface coal mining would permanently alter the topography of the proposed tract through blasting, hauling, and stockpiling of overburden and interburden, as described in section 1.1.3.3. Mining would remove overburden and interburden to a combined average depth of approximately 250 feet and coal to a combined total depth of about 100 feet over approximately 419 acres. Mining support activities, described in section 1.1.3.3, would cause temporary surface disturbance a buffer area to the north of the proposed tract.

The postmining topography would be recontoured using methods described in section 1.1.3.4 to resemble the premining topography, but would be approximately 60 feet lower (table 3.2-1) and somewhat gentler and more uniform. The removal of coal would be partially offset by the swelling that occurs when overburden and interburden are blasted, excavated, and backfilled. Direct adverse impacts resulting from topographic moderation include a reduction in habitat diversity and microhabitats (e.g., cutbank slopes). These impacts would be greater in those areas characterized as rough breaks. Potential effects of topographic moderation on wildlife species are described in section 3.10. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur because of higher density of reclaimed soils near the surface (section 3.8.2.1). It may also increase vegetative productivity and potentially accelerate recharge of groundwater. In-channel stockponds and playas (i.e., shallow topographic depressions) would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support the anticipated future land use. All postmining topography and water features must meet the specifications outlined in the mining and reclamation plan approved by the WDEQ/LQD.

Table 3.2-1. Overburden/Coal Thickness and Postmining Elevation Change

Average overburden thickness (including interburden)	250 feet
Average coal thickness	100 feet
Overburden swell factor	11%
Coal recovery factor	90%
Postmining elevation change[1]	–61 feet

[1] Reclaimed (postmining) elevation surface change is calculated as:
(overburden + unrecovered coal thicknesses) x (overburden swell) – (overburden + coal thicknesses)

3.2.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.2.2.3 Alternative 2

Under Alternative 2, surface coal mining would permanently alter the topography as described under the Proposed Action but over an area of up to 1,883 acres. Temporary surface disturbance from mining support activities would affect a 0.25-mile-wide area around the final tract configuration. The existing diversion of Hay Creek in the general analysis area would be expanded to direct flow into temporary channels around active mining areas, as needed, or that flow would be contained within temporary reservoirs to prevent pits from being flooded. Kiewit does not anticipate any further diversions on Hay Creek due to the operationally limited lands west of the county road. Additional mining and reclamation activities and postmining topography would be the same as described under the Proposed Action.

3.2.3 Regulatory Compliance, Mitigation, and Monitoring

WDEQ/LQD Rules and Regulations (Chapter 4) require that topography be restored as closely as possible to premining contour and that it blend into the existing, undisturbed topography as much as possible. If one of the action alternatives is implemented Kiewit will reconstruct features such as hills and draws to mimic premining conditions. Some local relief will be reduced after coal removal. The amount of coal that would be removed and the degree to which the overburden spoils would change in volume due to excavation would be considered in the postmine topography design. These designs will be developed for approval as part of the required mining and reclamation plans. All topographic features such as upland draws, channel bottoms, and elevations will be reconstructed to closely mimic premining conditions and ensure proper drainage of water across the reclaimed spoils. The WDEQ/LQD monitors topographic restoration by regularly checking the as-built topography in the annual reports filed by the mines to see if it conforms to the approved topography.

Under either of the action alternatives, Kiewit will reestablish vegetation in all reclaimed areas and implement sediment-control measures where runoff occurs to preserve reclaimed materials. Kiewit will monitor success of revegetation and erosion-control measures routinely, per WDEQ/LQD guidelines, and will implement mitigation measures, as necessary, to correct any deficiencies.

3.2.4 Residual Impacts

Topographic moderation is a permanent consequence of mining. Reclaimed landforms are expected to mimic premining topography, but will have less topographic variation and will be slightly lower in elevation. Any indirect impacts of topographic moderation on wildlife habitat diversity would also be considered permanent. See section 3.10 for indirect impacts on wildlife as a result of topographic moderation.

3.3 Geology, Mineral Resources, and Paleontology

This section discusses the topographic, geologic, and mineral resources in the general analysis area and adjacent Buckskin Mine permit area, including assessments of premine topography and pertinent information regarding geology, as well as coal, CBNG, and scoria resources.

3.3.1 General Geology and Coal Resources

3.3.1.1 Affected Environment

The general analysis area contains the following stratigraphic units (layers) (in descending order from the surface): Quaternary (recent) deposits, the Eocene Wasatch Formation, and the Paleocene Fort Union Formation. The Paleocene Fort Union Formation contains the coal seams that would be mined under the action alternatives. Table 3.3-1 shows the stratigraphic relationships of the geologic units in the general analysis area. These stratigraphic units are discussed below.

Quaternary deposits in the general analysis area consist of unconsolidated stream-laid deposits, slope wash, wind-blown deposits, colluvium, residuum, and scoria. Stream-laid deposits occur in portions of the Hay Creek valley bottom and some associated upland draws beyond the general analysis area for this EIS. Those deposits consist of a loose mix of sand, gravel, and silt deposited by stream flow within Hay Creek and its tributaries. Slope wash occurs along the bottom slopes of hills and in channel bottoms, including the Hay Creek valley bottom in section 18, and consists of reworked sediment deposited by flow over the ground surface (e.g., runoff). Some surface sands are concentrated into small areas comprised predominately of fine-grained sand. Residuum (residual material) deposits commonly cover and are derived in place from the underlying Wasatch deposits, and may occur on relatively steep terrain. Colluvium is comprised of material that has been transported downslope by rock falls, slides, and slumps, and occurs along steep hill sides. This material generally consists of large, angular scoria and rock fragments residing in an unsorted matrix of sand, silt, and clay. Materials above some of the shallow coal seams in the general analysis area have been altered by the natural combustion (burning) of underlying coal seams, producing scoria which dominates portions of the hillsides in sections 8 and 9.

Table 3.3-1. Stratigraphic Relationships and Hydrologic Characteristics, Powder River Basin, Wyoming

Geologic Unit			Hydrologic Characteristics
Recent Alluvium (Holocene)			Typically fine grained and poorly sorted in intermittent drainages. Occasional very thin, clean interbedded sand lenses. Low yields and excessive dissolved solids generally make these aquifers unsuitable for domestic, agricultural and livestock usage. Low infiltration capacity unless covered by sandy eolian blanket.
Clinker (Holocene to Pleistocene)			Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria or red dog) formed by melting and partial fusing from the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated.
Wasatch Formation (Eocene)			Lenticular fine sands interbedded predominantly very fine grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch formation generally does not meet Wyoming Class I drinking water standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality which does meet the Class I standard.
Fort Union Formation (Paleocene)	Tongue River Member	Wyodak Formation Splits: Anderson/ Canyon Seams	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use.
	Lebo Member		The Lebo Member, also referred to as "The Lebo Confining Layer," has a mean thickness of 711 feet in the PRB and a thickness of about 400 feet in the vicinity of Gillette. The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm.
	Tullock Member		The Tullock Member has a mean thickness of 785 feet in the PRB and a mean sand content of 53% which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common buy vary locally and may be as much as 40 gpm. Records from the State Engineer's Office indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
Lance Formation (Upper Cretaceous)	Upper Lance		Sandstone and interbedded sandy shales and claystone provide yields generally of less than 20 gpm. Higher yields are sometimes achieved where sand thicknesses are greatest. Water quality is typically fair to good.
	Fox Hills Sandstone		Sandstone and sandy shales yield up to 200 gpm, however, yields are frequently significantly less. The water quality of the Fox Hills is generally good with TDS concentrations commonly less than 1000 milligrams per liter.
Lewis Formation (Upper Cretaceous)	Pierre Shale		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions is solution.

gpm = gallons per minute

Sources: Hodson et al. (1973) and Lewis and Hotchkiss (1981).

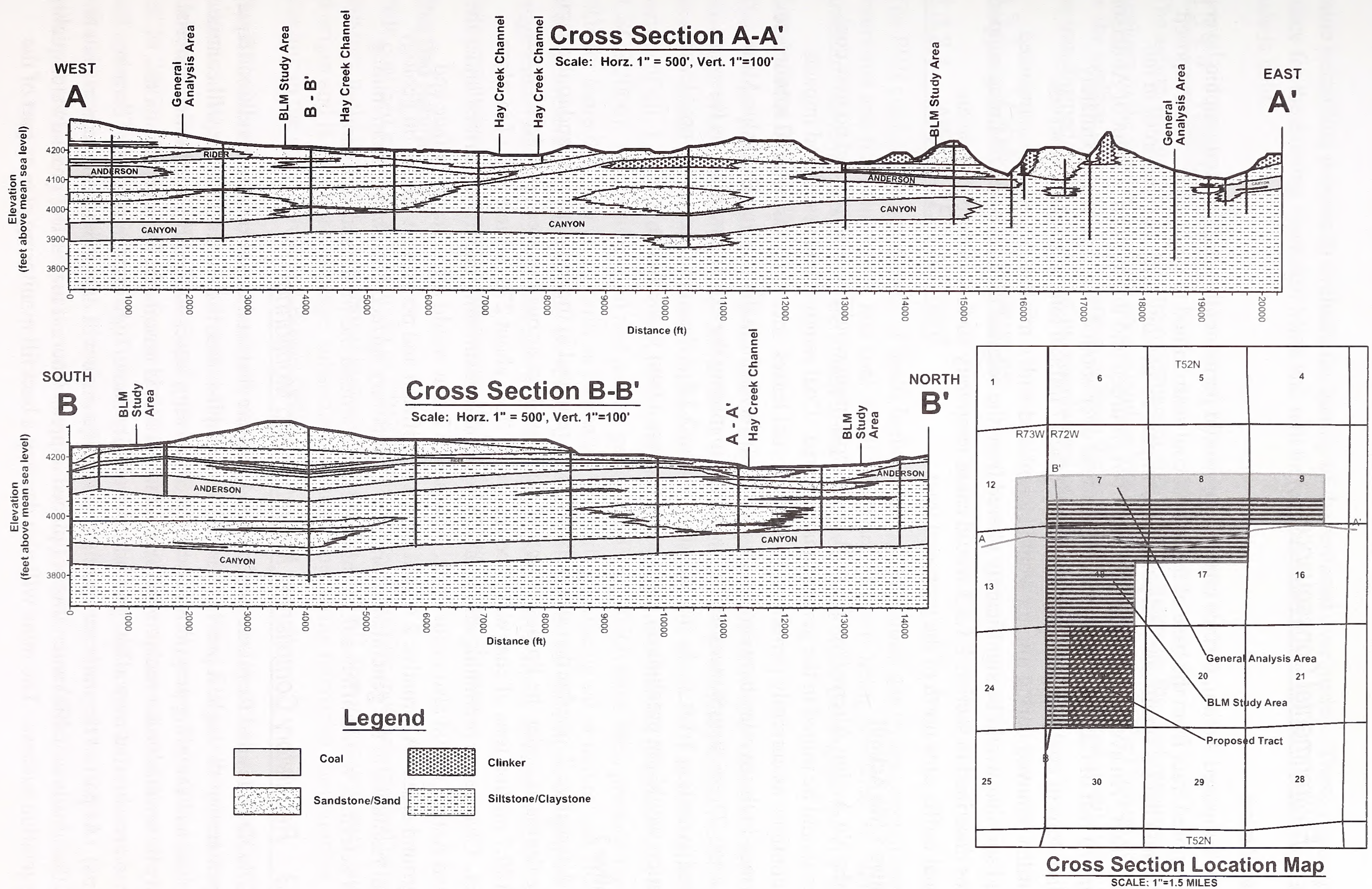
The Wasatch Formation in the general analysis area consists of sandstone, siltstone, shale, and thin coals that extend from the surface to the Anderson coal seam; that seam defines the top of the underlying Fort Union Formation. The Wasatch Formation is somewhat sandier than the underlying Fort Union Formation, especially near the surface, where sands can be traced laterally for considerable distances. The Rider coal seam occurs in the Wasatch Formation; it is present in much of the western portion of the general analysis area, but in the east the coal layer thins out, is eroded out, or is burned. The Rider seam is up to 15 feet thick in the general analysis area, but is not a target coal for mining.

The Wasatch Formation, in combination with any overlying Quaternary deposits, is considered overburden relative to the shallow-most (Anderson) coal seam that is targeted for mining in the general analysis area. The overburden thickness varies from about 30 to 200 feet. It is thinnest in low-lying draws in sections 8 and 9 and in the valley bottom of Hay Creek in section 18.

The Fort Union Formation lies between the Anderson and Canyon coal seams, and consists primarily of sandstones, siltstones, shales, mudstones, and coal. The formation is divided into the Tongue River, Lebo, and Tullock members. Two coal seams are present in the Tongue River Member of the Fort Union Formation, both of which are targeted for mining in the BLM study area (the maximum extent of leasable coal in the general analysis area). Two geologic cross sections through the proposed tract are shown on figure 3.3-1. The Anderson seam resides at the top of the Fort Union Formation and defines the contact between the Fort Union and the overlying Wasatch formations. The Canyon coal seam is lower in the Tongue River member, typically 150 to 190 feet beneath the Anderson, but it is within 40 feet of the Anderson where the seams are present in the northeastern portion of the BLM study area.

The Anderson coal seam is present in most of the western portion of the BLM study area (maximum coal lease boundary), but it is discontinuous and absent in most of the northern and eastern portions. Where present, it averages about 45 feet thick and ranges from about 30 to 65 feet thick. The Canyon coal seam is present in most of the western portion of the BLM study area, but it is absent in most of the eastern portion. Where present, it averages about 70 feet thick and ranges from about 55 to 75 feet thick.

The Canyon and Anderson coal seams are sub-bituminous and are generally low-sulfur, low-ash coals. In the BLM study area, the heating value of the coal seams is expected to range from 8,000 to 8,500 British thermal units (Btu) per pound. The ash content in the coal seams is expected to vary from 3.5 to 7.0%, the sulfur content from 0.2 to 0.5%, and the moisture content from 28 to 31%.



No warranty is made by the Bureau of Land Management for use of these data for purposes not intended by BLM.

Figure 3.3-1
North-South and East-West Geologic Cross Sections

3.3.1.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining would permanently alter the stratigraphic layers in the proposed tract from the base of the lowest coal seam mined to the surface. The Proposed Action would have a significant and permanent impact on geology and coal resources in the proposed tract. An average of about 250 feet of overburden and interburden, 30 feet of Anderson coal, and 70 feet of Canyon coal would be removed over about 419 acres. Approximately 54 million tons of coal would be recovered from the 77 million tons of in-place reserves. Overburden removed during mining would be replaced with a mixture of partially compacted rock and soil that would be significantly altered from the original distinct layers. Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance on an additional buffer area north of the proposed tract.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Coal removal and associated impacts would continue as currently permitted on existing coal leases, including surface and subsurface disturbance in the overlap between the general analysis area and the existing Buckskin Mine permit area. Those disturbances would be related to mining the existing contiguous leases, as described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the future.

Alternative 2

Under Alternative 2, overburden and coal would be removed in the same manner and to the same average depths as under the Proposed Action, but would occur over an area up to 1,883 acres. Up to 149.7 million tons of coal would be recovered from about 270 million tons of in-place reserves. Changes to premining stratigraphic layers and postmining backfill described under the Proposed Action would also occur under Alternative 2, but would affect more surface and underground areas. Alternative 2 would have a significant and permanent impact on geology and coal resources in the general analysis area. Temporary surface disturbance from mining support activities would affect a 0.25-mile-wide area around the final tract configuration.

3.3.1.3 Regulatory Compliance, Mitigation and Monitoring

WDEQ/LQD Rules and Regulations (Chapter 4) require that land be restored to conditions equal to or greater than the highest previous use. To accomplish this, the Buckskin Mine will continue the drilling and sampling programs conducted on existing leases to identify overburden material that may be unsuitable for reclamation (i.e., material that is unsuitable for revegetation in disturbed areas or that may affect groundwater quality due to high concentrations of certain elements). As part of the mine permitting process, the mine will develop a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. The mine will also develop a backfill monitoring plan as part of the

mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Buckskin Mine and will be revised under either action alternative if a lease sale is held.

3.3.1.4 Residual Impacts

The action alternatives would have permanent significant impacts on the coal resources and geology in the general analysis area extending vertically from the base of the Canyon coal seam to the surface. Coal would be removed from the area, and the current layered stratigraphy would be transformed into a mixture of unconsolidated backfill material.

3.3.2 Other Mineral Resources

3.3.2.1 Affected Environment

The PRB contains large reserves of fossil fuels including oil, natural gas (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (Wyoming State Geological Survey 2003).

Conventional Oil and Gas

The Powder River structural basin is one of the richest petroleum provinces in the Rocky Mountain area. As of December 2006, the U.S. Geological Survey (USGS) estimated the mean levels of undiscovered oil and non-coal bed natural gas resources in the PRB as 639 million barrels of oil, 1.16 trillion cubic feet of natural gas, and 131 million barrels of natural gas liquids (USGS 2006). Conventional oil and natural gas (excluding CBNG) have been produced in the PRB for more than 100 years, with an estimated 500 fields producing oil or natural gas from oil-bearing strata during that period. Depths to conventional gas and oil-bearing strata generally range from 4,000 and 13,500 feet below grade, though some wells are as shallow as 250 feet.

No conventional oil and gas wells are located in the general analysis area.

Coal Bed Natural Gas

PRB coal bed methane (also known as CBNG) is naturally occurring methane trapped by water pressure in the coal or by impermeable strata above it. In the PRB, this gas is primarily biogenic in origin and is generated by large, subsurface, naturally occurring microbial communities residing in the coal (Ulrich and Bower 2008).

The BLM has completed numerous environmental assessments and three EISs analyzing CBNG projects in Wyoming. The most recent of these analyses is the Final EIS and Proposed Plan Amendment for the PRB Oil and Gas Project, referred to as the Wyoming PRB Oil and Gas EIS (BLM 2003). The EIS covers almost 12,500 square miles, encompasses almost the entire PRB and spans all or parts of Campbell, Converse, Johnson, and Sheridan counties, and covers private, state, and federal lands. It analyzes potential environmental impacts of CBNG development in the PRB, and assumes that approximately 39,400 new CBNG wells would be

drilled, completed, and produced over the next 10 years, in addition to the more than 12,000 CBNG wells that had been drilled or were permitted for drilling when the EIS was prepared.

Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal seams; this commonly occurs in the PRB. CBNG has been commercially produced in this region since 1989 when production began at the Rawhide Butte Field, approximately 5 miles southwest of the general analysis area (De Bruin and Lyman 1999). CBNG exploration and development are currently ongoing throughout the PRB. The predominant CBNG production to date in the general analysis area has occurred from the Wyodak-Anderson coal zone, which includes the Anderson and Canyon coal seams at and adjacent to the Buckskin Mine. The Wyodak-Anderson zone appears to be gas-bearing throughout the PRB and, as described above, the methane in the coal beds has been determined to be biogenic in origin. CBNG is also produced from deeper coal beds in the PRB, below the Anderson and Canyon seams.

In order for CBNG to be collected, the hydrostatic pressure in the coal must be reduced to a level that can vary from seam to seam, which allows the gas to desorb (release) from the coal. This is accomplished by removing water from the coal bed. CBNG reservoirs can be affected by any nearby activities, including coal mining, that reduce the hydrostatic pressure in the coal bed or by the introduction of atmospheric oxygen or other substances which interfere with the metabolic processes of the methane producing bacteria which naturally occur there. The BLM Wyoming State Office–Reservoir Management Group (WSO-RMG) has recently prepared a variety of detailed analyses of CBNG resources in the lands near the existing surface coal mines in the Wyoming PRB for coal leasing and other actions. The WSO-RMG completed a report in 2006 that describes the existing/affected environment of the coal mining areas and adjacent lands with respect to CBNG resources, and documents the observed and inferred resource depletion that has and will continue to occur (WSO-RMG 2006).

WSO-RMG and the USGS have collected coal gas content data from coal cores near the mines and in other areas of the PRB. Measured gas content was minimal in all of the Wyodak-Anderson coal cores collected in 2000 at locations near the surface coal mines, indicating that the coal seams were already substantially depleted of CBNG in the vicinity of the mines at that time. Average total gas content from the core desorption analyses was approximately 6.8 standard cubic feet per ton near the coal mines in 2000, compared with an average measured gas content of 37.6 standard cubic feet per ton from coal cores taken outside the mining areas. Analyses performed by WSO-RMG, USGS, CBNG operators, and others have shown that dewatering of the coal beds, by both CBNG production and mine dewatering, reduces the hydrostatic pressure in the coals and allows the gas to desorb and escape from the coal, and decreases the anaerobic production of methane. These effects have been ongoing, and it is likely that desorption and decreased production has continued since 2000; as a result, coal gas content and the gas-in-place adjacent to the existing mines would currently be expected to be less than in 2000.

The Wyoming Oil and Gas Conservation Commission well data from the mining townships generally shows that operator interest in the eastern PRB mining areas peaked prior to 2000 and

declined rapidly following 2001. Activity had declined to almost negligible levels during 2005 (WSO-RMG 2006).

The Anderson and Canyon seams tapped for CBNG are the same seams that are being mined at Buckskin Mine. CBNG occurs in these seams within the general analysis area and is common in equivalent seams throughout the PRB. Wyoming Oil and Gas Conservation Commission records indicate that as of May 2008, 30 CBNG wells have been completed in the general analysis area (appendix E). Fifteen wells (13 in the Canyon seam and 2 in the Anderson seam) are producing and 3 wells (2 in the Canyon and 1 in the Anderson) have been shut in and may be re-instated for production in the future. Twelve other wells are no longer producing, have been permanently abandoned, or have expired permits (Wyoming Oil and Gas Conservation Commission 2009). Wyoming Oil and Gas Conservation Commission records indicate that no CBNG wells have been completed below the Anderson and Canyon seams within the general analysis area.

Manufactured Methane from Coal Beds

A large percentage of the discovered natural gas (methane) reserves are believed to have been generated through the anaerobic microbial process of methanogenisis (Rice and Claypool 1981). Methane gas produced in this manner is often referred to as biogenetic methane. This process uses a group of predominantly anaerobic microorganisms that metabolizes the complex organic molecules in hydrocarbon deposits and produces the gas as a waste product. Biogenic methane has been detected in a wide variety of unconsolidated sediment and rock types around the world, including PRB coals (Law et al. 1991; Rice 1993).

Luca Technologies Inc. has developed a method of producing biogenetic methane through methanogenisis. The company transforms uneconomically producing CBNG wells and uses the existing infrastructure for its coal conversion and methane production operations, which are handled by their directly owned subsidiary, Patriot Energy Resources. The company has completed a test project near Sheridan, Wyoming, and has begun operations using a chemical nutrient to feed the microbacteria currently residing in the PRB coal seams. These communities are currently capable of producing up to 30 million cubic feet per day when provided nutrients (DeBruyn pers. comm.). Methane produced in this manner has been commercially produced since 2007.

The amount of coal converted through methanogenisis is less than 1% at the current level of technology. The future rate of the technological development and production of methane using microbacteria is unknown at this time but it is expected that, with continued success and public demand for either methane, hydrogen, or other biological metabolic byproducts of the microbial consortia, such operations could remain in place for the foreseeable future and produce a product until the coal has been converted into carbon and other remnant components of PRB coal such as ash and sulfur. The company is exploring the possibility of developing the same technology to produce methane and/or other by-products from non-coal hydrocarbon substrates and deposits (DeBruyn pers. comm.).

Other Minerals

Bentonite, uranium, and scoria also are commercially produced in the PRB, though to a far lesser degree than the other resources discussed in this section. Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, making it usable in a number of common processes and products. Bentonite reserves have not been identified in the general analysis area.

Substantial uranium resources are found in southwestern Campbell and northwestern Converse counties. Uranium exploration and mining were quite active in the 1950s, when numerous claims were filed in the PRB. A decreased demand combined with increased foreign supply reduced uranium mining activities in the early 1980s, although staking of mining claims is currently increasing. No known uranium reserves exist in the general analysis area.

Scoria is present in the general analysis area and can be used for construction aggregate as well as a road treatment to provide traction in winter. Scoria occurs in relative abundance on portions of the hillsides in sections 8 and 9, along the northern edge of the general analysis area.

3.3.2.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining would have permanent impacts on oil and gas (conventional and CBNG) resources in and above the mined coal seam within the proposed tract (419 acres), but would have no impact on reserves below the lowest mined seam. Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance on an additional buffer area north of the proposed tract.

This action alternative would have no impact on bentonite, uranium, or scoria resources, because they are not present in the proposed tract.

During mining, other minerals present in the proposed tract could not be developed. Some of these other minerals could, however, be developed after coal mining and reclamation are completed. No conventional oil and gas wells are present in the proposed tract. No documented bentonite, uranium, or scoria resources are present either.

Thirteen producing CBNG wells are present in the general analysis area, which includes that tract. Before mining operations could begin, all active CBNG wells would have to be plugged and abandoned, and all gas production equipment would have to be removed. CBNG resources that have not been recovered from the Canyon and Anderson coal seams prior to mining would be lost when the coal is removed. Dewatering wells and active mining would combine with ongoing CBNG production to deplete the hydrostatic pressures and methane resources adjacent to mining areas a short time after mining would begin. It is also likely that any undrilled spacing units in the proposed tract will have been drained by production from the existing wells and nearby mining activity prior to initiation of mining. Mining operations within the proposed tract would not begin until permitting is completed, which generally requires several years after a

lease is acquired. By that time, it is likely that most of the economically recoverable CBNG resource would have been produced. Oil and gas (conventional and CBNG) reservoirs located below the mineable Canyon and Anderson coal seams would not be directly disturbed by coal removal. Those resources could be drilled and plugged prior to mining. Following mining and reclamation, oil and gas lessees could drill new wells to recover those resources from any productive reservoirs below the lowest mined coal seam. Redeveloping deep oil, gas, and CBNG reservoirs would likely occur only if the lessee believes that the value of the reserves justifies the expense of recompleting or drilling wells.

Alternative 1 (No Action)

Under the No Acton Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Coal removal and associated impacts would continue as currently permitted on existing coal leases, including surface and subsurface disturbance in the overlap between the general analysis area and the existing Buckskin Mine permit area related to mining the existing contiguous leases. Those activities would have permanent impacts on scoria reserves in portions of the overlap area. Gas resources could be developed uninterrupted. Indirect impacts on CBNG resources, described above, would continue as a result of dewatering activities in the overlap area. As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining would have permanent impacts on oil and gas (conventional and CBNG) reserves in and above the mined coal seam as described under the Proposed Action, but would have no impact on reserves below the lowest mined seam. Impacts would occur over an area of up to 1,883 acres. Gas reserves below the lowest mined coal seam would still be accessible to operators after mining and reclamation have been completed. No conventional oil and gas wells, bentonite, or uranium resources are present in the general analysis area. Mining would remove or reduce the scoria hills along the northern extent of the general analysis area, resulting in a permanent loss of those resources and a change in topographic relief. Temporary surface disturbance from mining support activities would affect a 0.25-mile-wide area around the final tract configuration.

3.3.2.3 Regulatory Compliance, Mitigation, and Monitoring

The potential does exist for conflicts between coal operations and CBNG and conventional oil and gas wells completed, ongoing, or possible in formations and coal beds below the Canyon and Anderson seams.

If the federal coal in the tracts is leased and conflicts do develop between the various industry operators under the action alternatives, several mechanisms are in place that can be used to facilitate recovery of the conventional oil and gas and CBNG resources prior to mining. These mechanisms include:

- The BLM could attach a multiple mineral development stipulation to the federal coal lease, which states that the BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued before the coal lease (see appendix D).
- Conventional oil and gas wells could be abandoned during mining and reclamation operations, then be recompleted or redrilled following mining.
- The BLM could offer royalty incentives to CBNG operators to accelerate production, as provided for in the BLM Instruction Memorandum (2003-253), to recover the natural gas while simultaneously allowing uninterrupted coal mining operations. This memorandum also states that it is the policy of the BLM to encourage oil and gas and coal companies to resolve conflicts between themselves; when requested, the BLM will assist in facilitating agreements between the companies.
- Mining the proposed tract or alternative tract configuration cannot occur until the coal lessee has a permit to mine the tract approved by the WDEQ/LQD and a Mineral Leasing Act mining plan approved by the Secretary of the Interior. Before the mining plan can be approved, the BLM must approve the Resource Recovery Protection Plan for mining the tract. Prior to approving the plan, the BLM can review the status of CBNG and conventional oil and gas development and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years, during which time CBNG resources can be recovered.
- Prior to mining the federal coal reserves, Kiewit could negotiate an agreement with owners and operators of existing oil and gas and pipeline facilities, regarding removal and relocation of their infrastructure.

Scoria is often removed during mining because its use in construction is deemed viable enough to segregate it from other overburden materials. It may be feasible to recover scoria from the overburden in sections 8 and 9 as part of the overburden removal process. Scoria not disturbed by mining under the action alternatives could also be removed after mining.

3.3.2.4 Residual Impacts

Scoria deposits excavated for construction or other uses would be permanently removed. CBNG resources not recovered before mining would be vented to the atmosphere and permanently lost. Oil and gas resources (conventional and CBNG) below the lowest coal seam to be mined could be recovered when mine operations are completed.

3.3.3 Paleontology

3.3.3.1 Affected Environment

Two formations exposed on the surface of the proposed tract could contain paleontological resources: the Paleocene Fort Union Formation and the Paleocene and Eocene Wasatch Formation (Breckenridge 1974; Love and Christiansen 1985). Both of these sedimentary formations are known to yield vertebrate fossils in Wyoming (Estes 1975; Roehler 1991; Secord 1998; Robinson et al. 2004).

The BLM's Potential Fossil Yield Classification system ranks geologic formations based on their potential to yield significant paleontological resources. The five main classes in the system are:

- class 1 – very low
- class 2 – low
- class 3 – moderate or unknown
- class 4 – high
- class 5 – very high

Additional subcategories have been identified within some classes. Under this classification system, the Fort Union Formation in the PRB is considered to be class 4 and the Wasatch Formation in that region is a class 3a (Hanson pers. comm.). A more detailed description of the two classifications for the Fort Union and Wasatch formations is provided below.

Class 3—Moderate or Unknown. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- often marine in origin with sporadic known occurrences of vertebrate fossils;
- vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently, predictability known to be low; or
- poorly studied and/or poorly documented; potential yield cannot be assigned without ground reconnaissance.

  Class 3a—Moderate Potential. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil is low but is somewhat higher for common fossils.

Class 4—High. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented but may vary in occurrence and predictability. Surface-disturbing activities may adversely affect paleontological resources in many cases.

> **Class 4a**—Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than 2 acres. Paleontological resources may be susceptible to adverse impacts from surface-disturbing actions. Illegal collecting activities may impact some areas.
>
> **Class 4b**—Areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts on the bedrock resulting from the activity.
>
> – Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
> – Areas of exposed outcrop are smaller than 2 contiguous acres.
> – Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
> – Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources (BLM 2007b).

As a result of the 2007 paleontological survey findings (described below), the classifications for the Fort Union and Wasatch formations in the PRB have changed. The Fort Union Formation was upgraded from a class 3 to a class 4 statewide average and the Wasatch Formation in the PRB was downgraded to class 3a, although outside the PRB the Wasatch is a class 5 statewide (Hanson pers. comm.).

Fossils other than vertebrates that occur in the Fort Union Formation include gastropods (limpets, snails and slugs), bivalves (oysters, mussels, and clams) and plant fossils. Fossils that occur in the Wasatch Formation include mammals, birds, fish, and reptiles (Jones & Stokes 2007).

A pedestrian reconnaissance survey for fossils was conducted in November 2007 for the general analysis area. All outcrops were closely inspected, including bare, sparsely vegetated, or thin soil areas; stream and drainage bank exposures; large colluvium, lag areas, and colluvium near outcrops. Several fossil types were found during the survey in four locations. Of the four localities, three were outside of the proposed tract but in the general analysis area, and one was within the BLM study area. Fossils found include: crocodilian scutes (bone plates under the skin); a short segment of a limb bone from a large mammal; a small unidentifiable bone fragment (possibly crocodile); gastropod shell fragments; and small, highly weathered, fossilized wood fragments from the Fort Union. None of these fossils is considered significant or of high scientific value. While the occurrences of crocodilian scutes, the limb bone, and small bone

fragments are notable because they are the only vertebrate fossils currently known from the PRB Fort Union Formation, they are not considered to be of high scientific value because they were solitary finds, and no sign of other vertebrate fossils was observed in the immediate area. In addition, the mammalian species to which the limb bone segment belongs could not be determined: neither the taxon nor element represented by the bone fragment could be identified (Jones & Stokes 2007). While these findings indicate other vertebrate fossils could be found in the general analysis area, the likelihood of such a find would be minimal.

No significant or unique paleontological resources or localities have been recorded within the general analysis area, no specific mitigation was recommended for paleontology, and no further paleontological work was recommended or required.

3.3.3.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining would have no impact on significant or unique paleontological resources on the surface of the proposed tract; however, paleontological resources beneath the surface of the proposed tract (419 acres) could be permanently lost. No significant fossils were found in the outcrops of the Fort Union and Wasatch formations exposed on the surface of the proposed tract. However, fossils with scientific significance could be present but not exposed at the surface. Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance on an additional buffer area north of the proposed tract.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Coal removal and associated impacts on paleontological resources, similar to those described above, would only occur in the overlap between the general analysis area and existing permit area as a result of currently permitted mining activities. As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining would have no impact on significant or unique paleontological resources on the surface of the general analysis area; however, paleontological resources beneath the surface could be permanently lost on up to 1,883 acres. Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance within a 0.25-mile-wide buffer around the final tract configuration.

3.3.3.3 Regulatory Compliance, Mitigation, and Monitoring

If a tract is leased under one of the action alternatives, the BLM will attach a stipulation (appendix D) to the lease requiring the operator to report significant paleontological finds to the

authorized federal agency and suspend production in the vicinity of the find until an approved paleontologist can evaluate the paleontological resource.

3.3.3.4 Residual Impacts

Paleontological resources not identified and removed prior to or during mining operations would be permanently lost. No such incidents have occurred within the existing Buckskin Mine lease, or elsewhere in the PRB coal region.

3.4 Air Quality

This section summarizes the affected environment in the general analysis area and the potential air quality impacts of the Proposed Action and alternatives. Appendix F provides background information on the air quality regulatory framework, regional conditions, modeling efforts, and the best available control technology (BACT) process. That appendix also provides the history of monitoring for particulate matter in the PRB. The information presented in this section and in appendix F is based on data provided by the Buckskin, Eagle Butte, Rawhide, Dry Fork, and Wyodak mines and from various state and federal sources. Existing and projected cumulative air quality impacts are discussed in chapter 4.

3.4.1 Background

3.4.1.1 Air Quality Determinants

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography, winds (speed and direction), and precipitation. In the mountainous region of the western U.S., topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. Local effects, however, are commonly superimposed on the general widespread weather regime and are only important during those periods when the large-scale wind flow is weak.

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors that affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperatures decrease and precipitation increases with increasing elevation. Section 3.1.1 contains additional information about the meteorology and climate in the general analysis area.

The general analysis area (map 3.0-1) is located in the northern portion of the PRB. The topography is primarily rolling plains and tablelands of moderate relief with occasional valleys and buttes. Elevations range from about 4,080 to 4,380 feet above mean sea level. The Big

Horn Mountains lie approximately 60 miles to the west and the Black Hills lie approximately 60 miles to the east.

3.4.1.2 Applicable Air Quality Standards and Regulations

The CAA requires the EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. These standards define the maximum level of air pollution allowed in the ambient air. The CAA established NAAQS for six pollutants, known as "criteria" pollutants, which "... cause or contribute to air pollution which may be reasonably anticipated to endanger public health or welfare and the presence of which in the ambient air results from numerous or diverse mobile or stationary sources." The six, present-day criteria pollutants are lead, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), and particulate matter (PM_{10} and $PM_{2.5}$), where PM_{10} is coarse particulate with mean aerodynamic diameters less than 10 microns and $PM_{2.5}$ is fine particulate with a diameter of 2.5 microns or less. Both particle sizes are small enough to penetrate into the lungs; $PM_{2.5}$ in particular can cause serious health problems.

Air quality regulations applicable to surface coal mining include the NAAQS, Wyoming Ambient Air Quality Standards (WAAQS), prevention of significant deterioration (PSD), new source performance standards, and the Federal Operating Permit Program (Title V). These regulatory programs are described in appendix F. Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and state implementation plans (SIPs) established under the CAA and the Clean Air Act Amendments of 1990. In Wyoming, air pollution impacts are managed by the WDEQ/AQD under the Wyoming Air Quality Standards and Regulations and the EPA-approved SIP. A memorandum of agreement dated January 24, 1994, between EPA and the State of Wyoming allows the WDEQ/AQD to use particulate monitoring in lieu of short-term modeling to assess 24-hour compliance and to predict short-term ambient impacts from mining. Annual impacts are predicted using the industrial source complex long-term model, version 3 (ISC3LT). Appendix F contains a more detailed discussion of compliance and BACT demonstration.

3.4.1.3 Emissions Sources in the General Analysis Area

Air quality conditions in rural areas are typically better than in large, urban, or heavily industrialized areas. The northern PRB is a semi-industrial area containing six surface coal mines, multiple power plants, numerous natural gas wells and conventional oil and gas wells, and supporting rail and road infrastructure. Occasional high concentrations of CO, O_3, and particulate matter may occur in this region as well as in the urban areas of Gillette, Sheridan, and Buffalo, especially under stable atmospheric conditions that occur during winter.

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, excavating, loading and hauling overburden and coal, and the large areas of disturbed land produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, PM_{10} particulate matter is the major significant pollutant from

coal mine point and fugitive sources. Emissions of nitrogen oxides (NO_x) from blasting and mining equipment exhaust can also be significant, particularly at the larger surface mines in the southern PRB.

As discussed in appendix F, NO_2 is a product of incomplete combustion at sources such as gasoline- and diesel-burning engines or from mine blasting activities. Generally, blasting-related NO_x emissions are more prevalent at operations that use the technique referred to as cast blasting (Chancellor pers. comm.). This describes a type of direct blasting in which the explosion is designed to cast the overburden from on top of the coal into the previously mined area. The Buckskin mine does not use this technique and does not anticipate doing so in the future. The higher strip ratios (ratio of overburden to coal) at Buckskin do not lend themselves to dragline excavation, with which cast blasting is commonly associated.

Concentrations of the six criteria pollutants in the PRB and applicable standards are shown in table 3.4-1.

Non-mining air pollutant emission sources in the region include:

- emissions exhaust (primarily CO and NO_x) from existing natural-gas-fired compressor engines used in production of natural gas and CBNG;
- gasoline and diesel vehicle tailpipe emissions of combustion pollutants, volatile organic compounds, carbon dioxide (CO_2), NO_x, PM_{10} particulate matter, $PM_{2.5}$ particulate matter, and SO_2;
- dust (particulate matter) generated by vehicle travel on unpaved graded roads, windblown dust from neighboring areas, agricultural activities such as plowing, and paved road sanding during the winter months;
- transport of air pollutants from emission sources located outside the region;
- emissions from railroad locomotives used to haul coal (primarily NO_2 and PM_{10}); and
- SO_2 and NO_x from power plants.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment

Particulates include solid particles and liquid droplets that can be suspended in air. Particulates, especially fine particulates such as $PM_{2.5}$, have been linked to numerous respiratory related illnesses and can adversely affect individuals with pre-existing heart or lung diseases. They are also a major cause of visibility impairment in many parts of the U.S. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes.

Table 3.4-1. Six Criteria Air Pollutant Concentrations and Applicable Standards in the Powder River Basin (μg/m³)

Criteria Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments	PSD Class II Increments
CO	1-hour	3,336[4]	40,000	40,000	40,000	—	—
	8-hour	1,381	10,000	10,000	10,000	—	—
NO_2	Annual	5[5]	100	100	100	2.5	25
O_3	8-hour	70[6]	147	147	147	—	—
SO_2	3-hour	181[7]	—	1,300	1,300	25	512
	24-hour	62[7]	365	—	260	5	91
	Annual	13[7]	80	—	60	2	20
PM_{10}[8]	24-hour	54[9]	150	150	150	8	30
	Annual	13[9]	—	—	50	4	17
$PM_{2.5}$[8]	24-hour	13[10]	35	35	65	—	—
	Annual	4[10]	15	15	15	—	—

μg/m³ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; WAAQS = Wyoming Ambient Air Quality Standards; PSD = Prevention of Significant Deterioration increment values; CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; SO_2 = sulfur dioxide; PM_{10} = particulate matter measuring 10 microns or less in diameter; $PM_{2.5}$ = particulate matter measuring 2.5 microns or less in diameter.

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.

3 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

4 Data collected by Amoco at Ryckman Creek for an 8-month period during 1978–1979, summarized in Riley Ridge EIS).

5 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002.

6 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002–2004 (8-hour 4th high).

7 Data collected by Black Hills Power & Light at Wygen 2, Campbell County, Wyoming in 2002.

8 On October 17, 2006, the EPA published final revisions to the NAAQS for particulate matter that took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 μg/m³ and revokes the annual PM_{10} standard of 50 μg/m³. The State of Wyoming entered into rulemaking to revise the WAAQS.

9 Data collected at the Eagle Butte Mine, Campbell County, Wyoming in 2002.

10 Data collected at the Buckskin Mine 2002.

Source: BLM 2005b.

The current (since December 2006) EPA 24-hour air quality standard for $PM_{2.5}$ is 35 micrograms per cubic meter ($\mu g/m^3$), a reduction from the previous level of 65 $\mu g/m^3$. The current annual $PM_{2.5}$ standard is 15 $\mu g/m^3$. The current 24-hour standard for PM_{10} particulates is 150 $\mu g/m^3$. The annual PM_{10} standard of 50 $\mu g/m^3$ was revoked during the EPA revisions of air quality standards in 2006. In view of the December 2006 revisions to the NAAQS for particulate matter, the State of Wyoming entered into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. Current federal ambient air standards for all six criteria pollutants are shown in table 3.4-1, including those for current PM_{10} and $PM_{2.5}$ standards in Wyoming. Additional information on the history of this process is provided in appendix F.

The PRB has one of the most extensive networks of monitoring sites for PM_{10} in the U.S.; most of these monitoring sites are funded and operated by the coal mines. The WDEQ/AQD requires that such information is collected to document the quality of the air resource at each of the PRB mines. According to EPA AirData, 36 PM_{10} monitors, 6 $PM_{2.5}$ monitors, and 6 total suspended particles (TSP) monitors were stationed in the Wyoming portion of the PRB in 2007. Data for TSP and PM_{10} date back to 1980 and 1989, respectively. Approximately 57,000 TSP samples were collected through 2004, and approximately 47,550 PM_{10} samples through 2007. Information about the regulatory framework, the monitoring network, and PM_{10} concentration trends since monitoring began are included in appendix F. Existing site-specific air quality information is included in the air quality data report, which can be viewed at the BLM High Plains District Office in Casper, Wyoming.

The Buckskin Mine ambient monitoring network consists of two low-volume Rupprecht & Patashnick Tapered Element Oscillating Microbalance (TEOM) PM_{10} particulate continuous monitors. The monitors were installed in late October 2000 to replace two high-volume TSP monitors located at the same sites. The continuous monitors collect uninterrupted, hourly average concentrations for particulate matter. The TEOM monitors meet the EPA Automated Equivalency Method (EQSA-0495-100). The particulate and meteorological monitoring network is operated in accordance with the *Buckskin Mine Quality Assurance Project Plan* (Buckskin Mining Company 2001), which was updated in 2008. Although they are no longer used at the Buckskin Mine, TSP monitoring is still conducted in some PRB locations, in part to serve as an indication of overall atmospheric levels of particulate matter.

The former high-volume air quality monitors at Buckskin sampled TSP every six days for a 24-hour cycle. The continuous TEOM monitors in use since 2000 are identified as west TEOM monitor (AQS ID: 0884) and north TEOM monitor (original AQS ID: 0899). In 2008, the north TEOM monitor was moved to a WDEQ/AQD approved location just outside the existing Buckskin Mine permit boundary (new AQS ID: 1899). The new site is more representative of ambient air and better positioned to measure both meteorological conditions and air quality impacts from mining. A meteorological station is also located at the new north TEOM monitor site. Current monitor locations are shown on map 3.4-1.

Table 3.4-2 provides the annual average, maximum, and second-highest PM_{10} concentrations for each monitor. These data were collected from 2002 through 2007. Annual coal and overburden production are also presented for reference. Figure 3.4-1 presents the same information in graphic form.

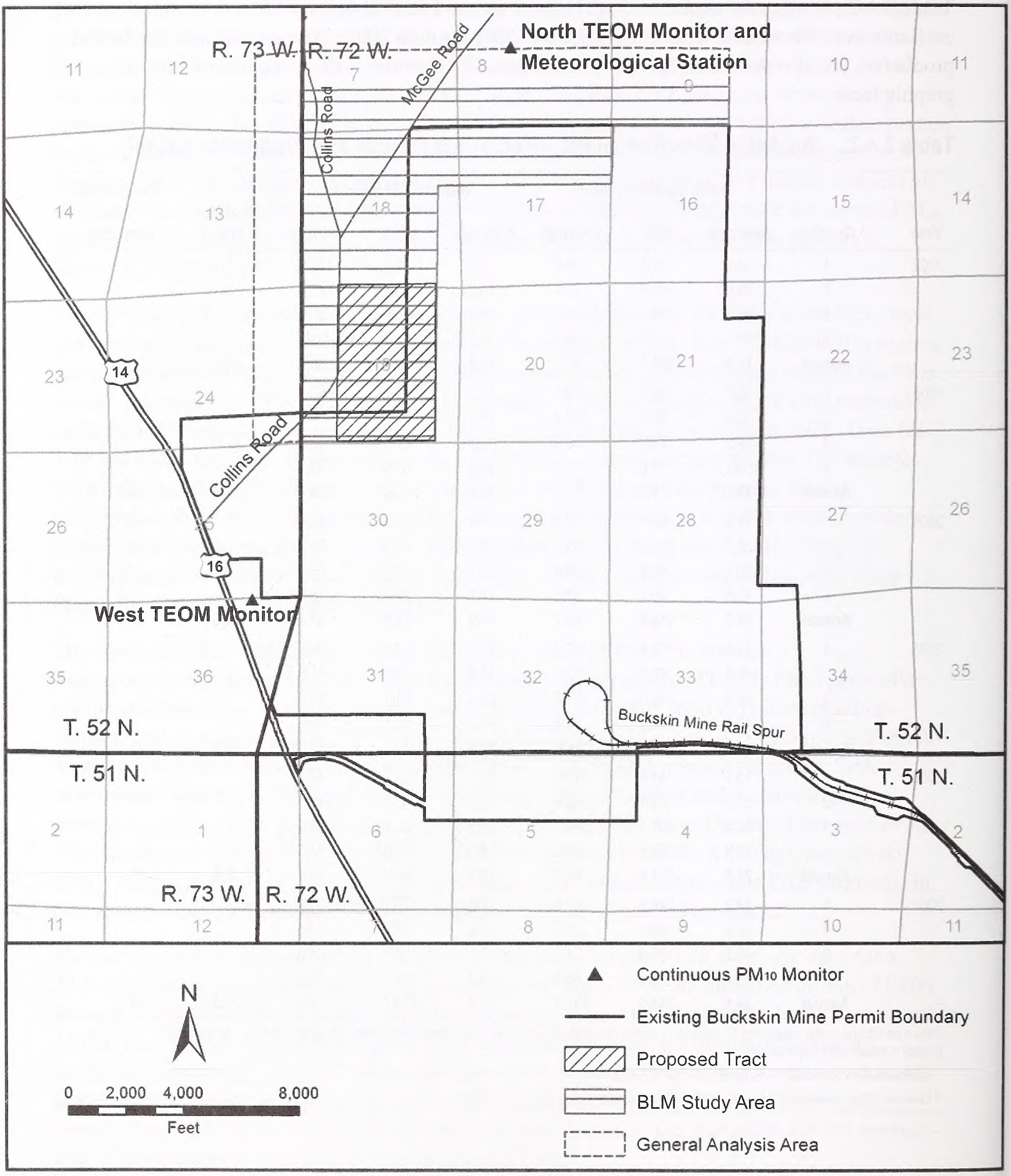
Table 3.4-2. Buckskin Mine Annual PM_{10} Monitoring Results and Production ($\mu g/m^3$)

Year	Quarter	North TEOM Monitor			West TEOM Monitor			Coal/Year (mmt)	Overburden/ Year (mmbcy)
		Average	High	2nd High	Average	High	2nd High		
2002	1	14.9	37.5	34.1	12.9	34.9	30.9		
	2	20.0	95.7	73.4	18.3	60.9	43.4		
	3	25.1	191.7[1]	71.0	21.9	70.5	57.9		
	4	11.1	29.3	22.6	11.5	25.7	23.3		
	Annual	**17.8**	**191.7**	**95.7**	**16.2**	**70.5**	**60.9**	18.3	36.5
2003	1	10.9	35.1	29.8	10.7	49.7	23.4		
	2	15.6	56.3	42.7	14.2	41.3	39.2		
	3	29.2	77.6	76.9	26.5	80.1	63.0		
	4	15.1	47.6	40.3	18.0	202.4[2]	139.1		
	Annual	**17.7**	**77.6**	**76.9**	**17.4**	**202.4**	**129.1**	17.5	31.9
2004	1	14.5	53.7	47.5	13.4	47.3	41.4		
	2	18.7	116.3	41.1	16.8	74.9	33.3		
	3	20.1	42.3	40.2	17.7	38.5	33.7		
	4	13.6	40.1	33.8	11.7	27.7	25.6		
	Annual	**16.7**	**116.3**	**53.7**	**14.9**	**74.9**	**47.3**	20.3	29.5
2005	1	14.0	78.5	47.0	12.7	48.5	30.9		
	2	16.4	68.8	58.7	14.9	48.5	46.6		
	3	25.3	60.0	51.6	24.4	61.1	53.8		
	4	13.1	42.2	41.3	12.3	57.1	32.8		
	Annual	**17.2**	**78.5**	**68.8**	**16.1**	**61.1**	**57.1**	19.6	26.1
2006	1	13.1	41.9	38.3	14.7	54.1	47.2		
	2	21.7	72.1	60.7	19.0	58.6	49.6		
	3	34.2	101.4	84.7	28.5	63.7	58.5		
	4	16.9	63.6	58.2	14.1	39.0	34.5		
	Annual	**21.5**	**101.4**	**84.7**	**19.1**	**63.7**	**58.6**	22.8	27.1
2007	1	18.9	244.0[1]	59.9	17.0	177.7[1]	62.9		
	2	20.2	102.5	59.0	19.6	75.3	54.5		
	3	40.2	107.3	84.6	31.1	72.5	68.9		
	4	18.4	75.6	65.9	13.6	53.7	42.8		
	Annual	**24.4**	**244.0**	**107.3**	**20.3**	**177.7**	**75.3**	25.3	31.7

PM_{10} = particulate matter measuring 10 microns or less in diameter; TEOM = Tapered Element Oscillating Microbalance; mmt = million tons; mmbcy = million bank cubic yards

[1] Exceeded 24-hr standard of 150 $\mu g/m^3$; WDEQ/AQD deemed "exceptional event" due to high winds.

[2] Exceeded 24-hr standard of 150 $\mu g/m^3$; WDEQ/AQD deemed as official exceedance.



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Map 3.4-1
Buckskin Mine Ambient Air Monitoring Network

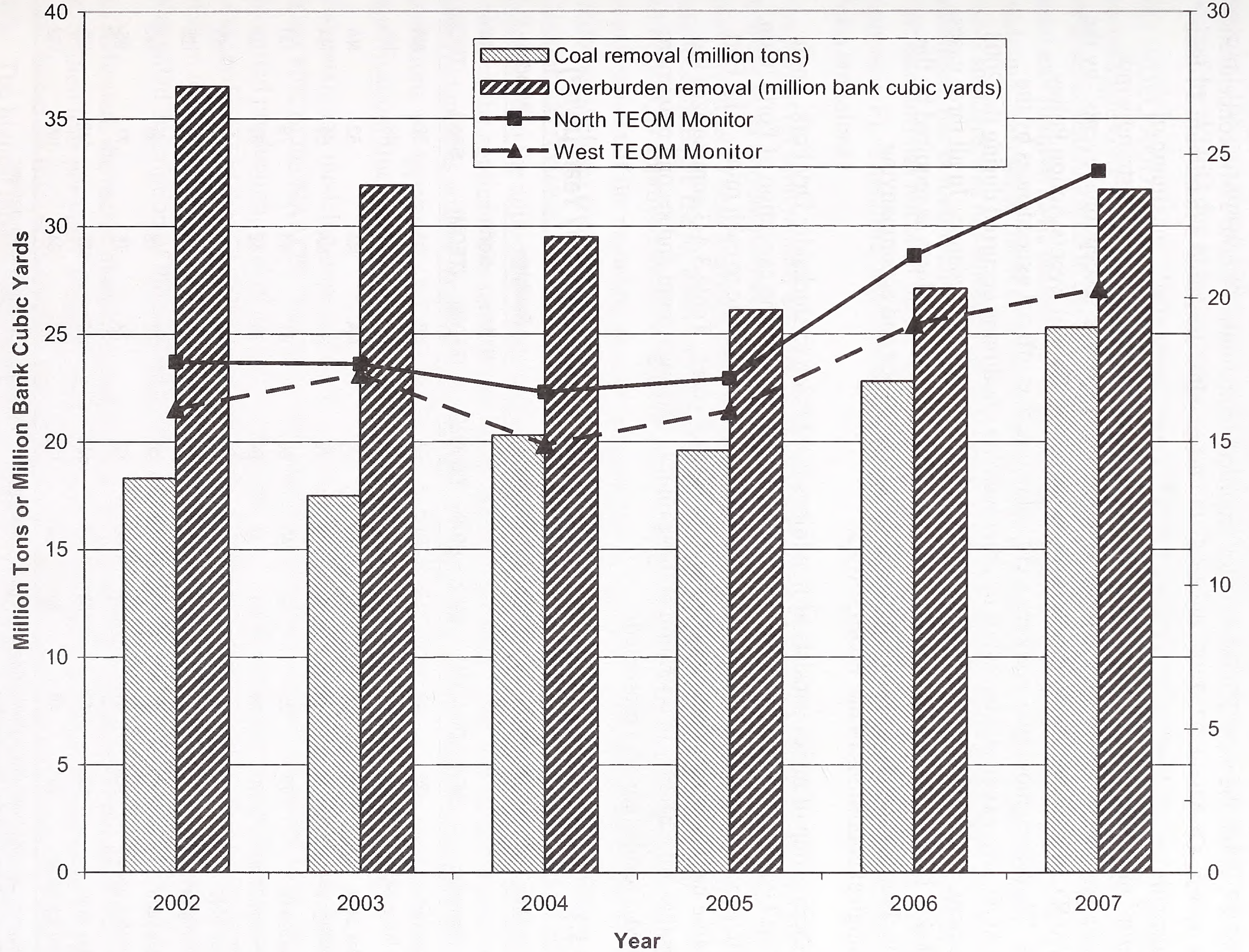

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Figure 3.4-1
Buckskin PM_{10} Monitoring History

Results from the Buckskin Mine 24-hour PM_{10} monitors surpassed the 24-hour annual average standard (150 μg/m^3) on only three occasions since monitoring began. On August 16, 2002, the north TEOM monitor recorded a maximum 24-hour PM_{10} concentration of 191.7 μg/m^3. On December 27, 2003, the west TEOM monitor recorded a maximum 24-hour PM_{10} concentration of 202.4 μg/m^3. On March 27, 2007, the north TEOM monitor measured a maximum 24-hour PM_{10} concentration of 244.0 μg/m^3; the west TEOM monitor recorded a maximum of 177.7 μg/m^3 the same day. The 2002 and 2007 measurements correlated with strong winds (e.g., more than 33 mph with gusts of 42 mph) and were judged as "exceptional events" by the WDEQ/AQD, as provided for by the recently implemented Natural Events Action Policy (NEAP). Therefore, those two overages were not counted as official exceedances by the WDEQ/AQD. No extraordinary winds or other weather conditions occurred during the 2003 measurement, and the WDEQ/AQD considered that event as an exceedance. In all three cases, the Buckskin Mine followed all mitigation and documentation procedures as required by the NEAP, including submitting detailed reports of the exceedance and accompanying meteorological conditions to the WDEQ/AQD.

The northern group of mines consists of five mines in addition to Buckskin: Dry Fork, Eagle Butte, Fort Union, Rawhide, and Wyodak. All of the mines, with the exception of Fort Union, operate in accordance with a Quality Assurance Project Plan specific to each mine. The Fort Union Mine has not been in operation for the last several years. Table 3.4-3 summarizes the monitors that are currently in operation at these mines. The maximum and second maximum annual PM_{10} results are also presented.

Table 3.4-3. Northern PRB Mines: 24-Hour PM_{10} Monitoring Results by Year (μg/m^3)

	Mine	Dry Fork		Eagle Butte			Rawhide		Wyodak	
Year	Sampler	DF-1	DF-N/3M	EB-2	EB-5	EB-N/3S	Hilltop (TEOM)	North (TEOM)	Site 1	Site 4 (TEOM)
2002	Max 24-hr	85	49	143	54	74	NA	NA	52	NA
	2nd-High 24-hr	79	34	66	36	66	NA	NA	48	NA
2003	Max 24-hr	96	45	65	47	76	NA	NA	52	NA
	2nd-High 24-hr	95	33	61	34	76	NA	NA	50	NA
2004	Max 24-hr	73	25	62	40	66	61	43	79	131
	2nd-High 24-hr	70	24	61	33	64	39	42	62	92
2005	Max 24-hr	113	29	60	49	115	76	61	129	165*
	2nd-High 24-hr	107	27	53	48	85	70	59	69	126
2006	Max 24-hr	112	68	73	47	99	72	78	96	143
	2nd-High 24-hr	103	44	60	46	93	72	75	71	95
2007	Max 24-hr	109	44	168*	41	144	107	178*	143	129
	2nd-High 24-hr	101	40	65	39	139	101	84	100	122

μg/m^3 = micrograms per cubic meter; PRB = Powder River Basin; PM_{10} = particulate matter measuring 10 microns or less in diameter; TEOM = Tapered Element Oscillating Microbalance

* Exceeded 24-hr standard of 150 μg/m^3 ; WDEQ/AQD deemed "exceptional event" due to high winds.

NA = Sampler not installed

Collectively, the five other mines in the northern group exceeded the 24-hr PM_{10} NAAQS annual average of 150 μg/m^3 three times during the last six years (2002 through 2007). In 2005, the Wyodak Mine recorded a value of 165 μg/m^3. In 2007, the Eagle Butte and Rawhide mines recorded 168 μg/m^3 and 178 μg/m^3, respectively. All three values were deemed "exceptional events" by WDEQ due to high winds.

The WDEQ/AQD requires that surface mine permits compile detailed emissions inventories and demonstrate compliance with NAAQS before permit amendments are granted. A BACT analysis is also required to demonstrate the use of "best available technology" in controlling point and fugitive PM_{10} emissions. In 2006, the Buckskin Mine submitted detailed PM_{10} modeling analyses to the WDEQ/AQD in support of a request for a permit modification. The $PM_{2.5}$ standard was not enforced by Wyoming when this permit amendment application was submitted, nor is it currently applied to modeling of surface mine emissions. In addition, the old TSP standard has not been part of the state's monitoring requirements for more than 10 years (appendix F). Therefore, any discussion of particulate modeling in Wyoming is confined to PM_{10} emissions.

The permit revision request addressed the impacts associated with a proposed production increase to its current permitted level of 42 million tons per year and proposed improvements to mine facilities. These analyses considered all PM10 emission sources and included the neighboring Eagle Butte, Rawhide, Dry Fork, Wyodak, and Fort Union mines. The WDEQ/AQD approved the mine modification in Permit MD-1379, issued January 17, 2007. In its assessment of the modeling process, the agency noted that "…the applicant's dispersion modeling analyses were conducted using U.S. EPA approved models and methodologies, and the Division has reviewed and verified the source parameters, default settings, and related modeling inputs used in the applicant's modeling analyses. Through the required dispersion modeling analyses, the applicant has successfully demonstrated to the Division that all applicable air quality standards will be attained if the proposed changes in the applicant's mine plan and mining operations are approved" (WDEQ/AQD 2006). Based on WDEQ/AQD approval of this permit modification, Buckskin is not aware of any significant technical or modeling issues.

The maximum modeled impact from Buckskin and neighboring mines (including background) is about 80% of the NAAQS. The modeling analysis demonstrated that emissions from the permitted production level of 42 million tons per year would not cause or significantly contribute to exceedances of the NAAQS annual average. Buckskin's current production level of 25 million tons per year is expected to continue under the action alternatives considered in this EIS. A detailed description of the modeling process for this analysis is provided in appendix F.

As indicated, the recent modeling analysis was conducted for a maximum coal production rate of 42 million tons per year. Mining years 2011 and 2012 were selected as the projected "worst-case" based on Buckskin-specific and regional life-of-mine emission inventories for PM_{10} and NO_x. The highest model-predicted PM_{10} impact from Buckskin and neighboring mines during either year was 40.4 μg/m^3 (including a background concentration of 12 μg/m^3) compared to the annual WAAQS of 50 μg/m^3. Moreover, at the model receptor with highest predicted

cumulative impact, Buckskin's contribution was less than 1 $\mu g/m^3$. The maximum predicted contribution from Buckskin at any receptor was 16 $\mu g/m^3$. Given that the highest prediction for either worst-case year falls below the annual PM_{10} WAAQS, that standard is expected to be met throughout the life of the mine. Map 3.4-2 shows the modeled PM_{10} and NO_2 impacts at receptors located along the permitted Buckskin Mine boundary for 2011. Map 3.4-3 shows the same parameters for 2012. Both maps also depict the area sources used to model fugitive emissions.

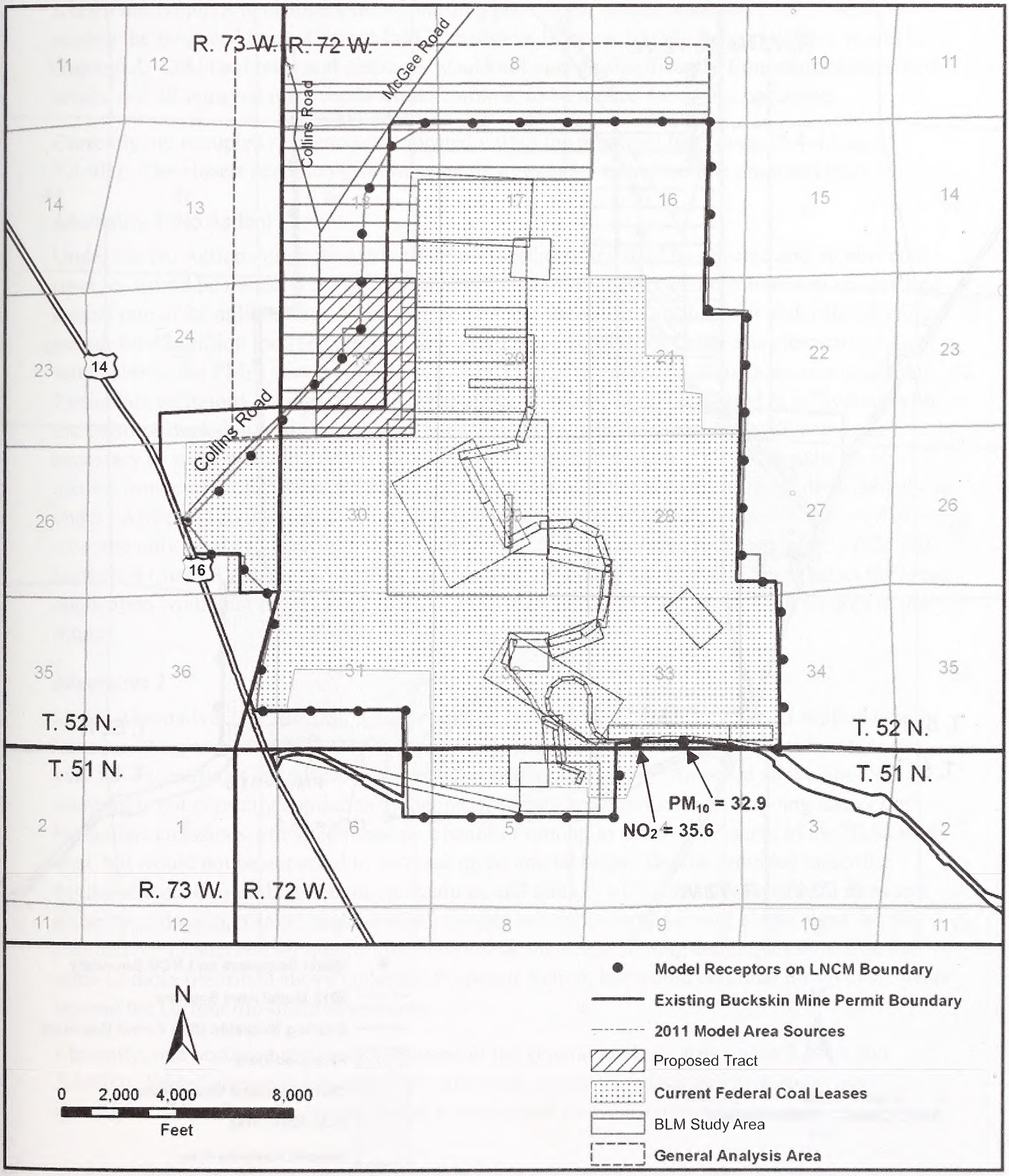
In addition to these modeling analyses, the Buckskin Mine also prepared a demonstration of short-term compliance with the 24-hour PM_{10} standard based on results from a single monitoring cycle as part of the 2006 air quality permit modification request. According to WDEQ/AQD policy (appendix F), a modeling analysis for short-term data was not required or conducted because the model tends to significantly over-predict 24-hour impacts of surface coal mines, and the agency therefore considers it to be an inaccurate representation of those impacts. Instead, the short-term compliance analysis focused on historical monitoring data and continuing employment of BACT on mine-wide emissions. That analysis again concluded that the 24-hour PM_{10} WAAQS would be protected throughout the life of the mine.

Fugitive emissions are the greatest emission source for surface coal mines in the Wyoming PRB. Such sources do not count against the PSD major source applicability threshold for incremental increases in criteria pollutants. Therefore, Buckskin and the other Wyoming PRB coal mines have not been subject to permitting under the PSD regulations because the mine emissions that are subject to PDS applicability levels fall below the allowable thresholds. Additional information regarding PSD requirements is provided in appendix F. Based on permits in place in the baseline year of 1997, when the Clean Air Act Amendments were enacted, only some fraction of the mine emissions included in the WDEQ/AQD air quality permit analyses contributes to the allowable increase (increment) in criteria pollutants in the region. Therefore, the concentrations predicted by the WDEQ/AQD air quality permit analyses should not be compared to PSD increments.

3.4.2.2 Environmental Consequences

Proposed Action

Under the Proposed Action, production would continue at the existing annual rate of 25 million tons. Because PM_{10} exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this alternative. As stated above, the $PM_{2.5}$ standard is not currently applied to modeling of surface mine emissions. Ongoing sources of particulate emissions would continue as a result of mining the proposed tract, but would not be expected to increase on an annual basis. Impacts on air quality from current facilities and mining techniques would be the same as those described above under "Affected Environment," but would continue for up to two years beyond the current life-of-mine estimate.



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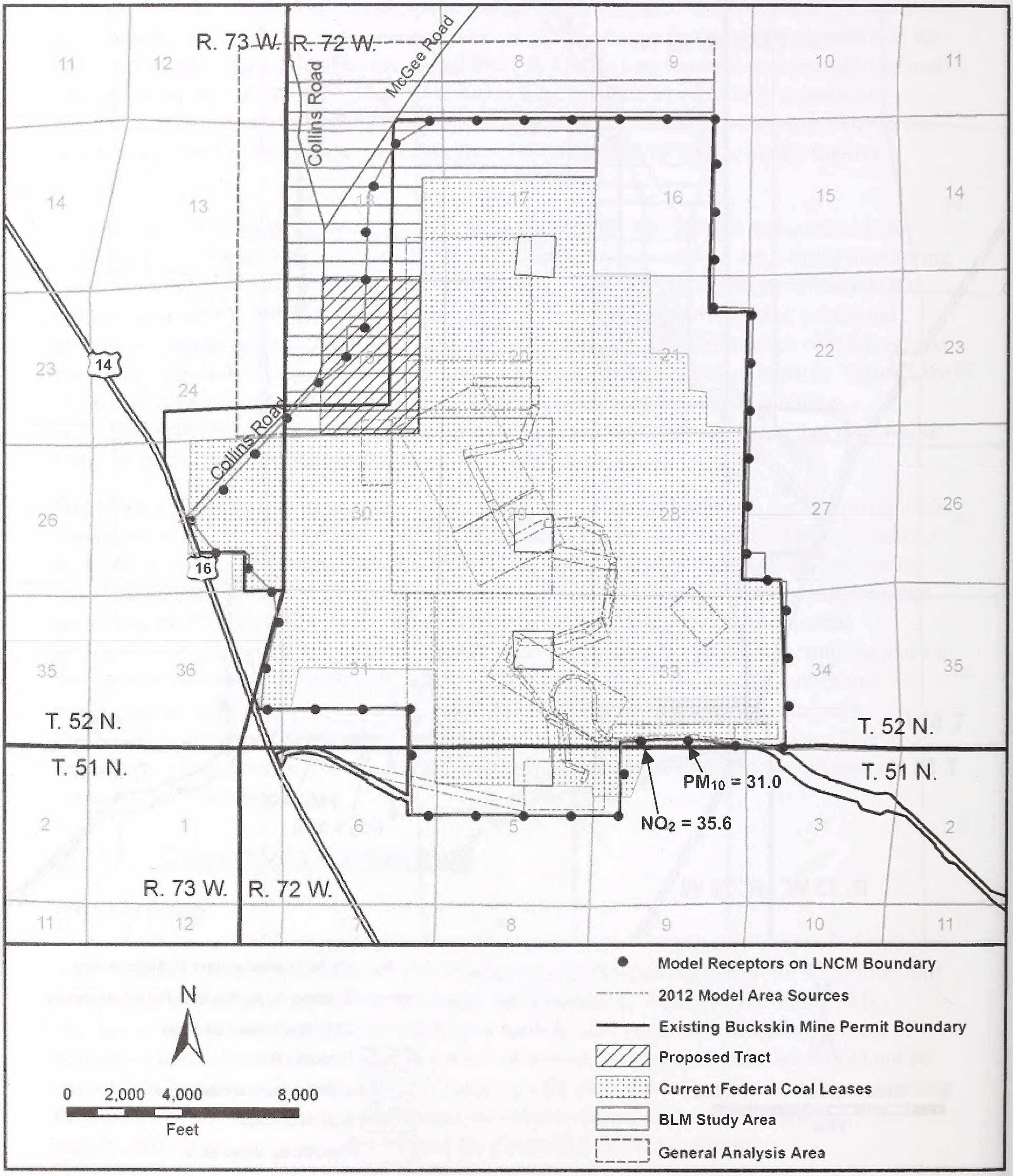
Map 3.4-2

2011 Maximum Modeled PM_{10} and NO_2 Concentrations for Buckskin Mine Ambient Air Boundary



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Map 3.4-3

2012 Maximum Modeled PM_{10} and NO_2 Concentrations for Buckskin Mine Ambient Air Boundary

Kiewit has no plans to change existing blasting procedures or sizes (section 1.1.3.3) when mining the proposed tract. Current BACT measures (section 3.4.2.3) for particulates would be employed. Coal haul rates and distances would not change significantly from current permitted levels, and all unpaved mine roads would continue to be treated for dust suppression.

Currently, no occupied residences are located within the proposed tract (maps 3.4-4A and 3.4-4B). The closest occupied dwellings are more than 0.5 mile from the proposed tract.

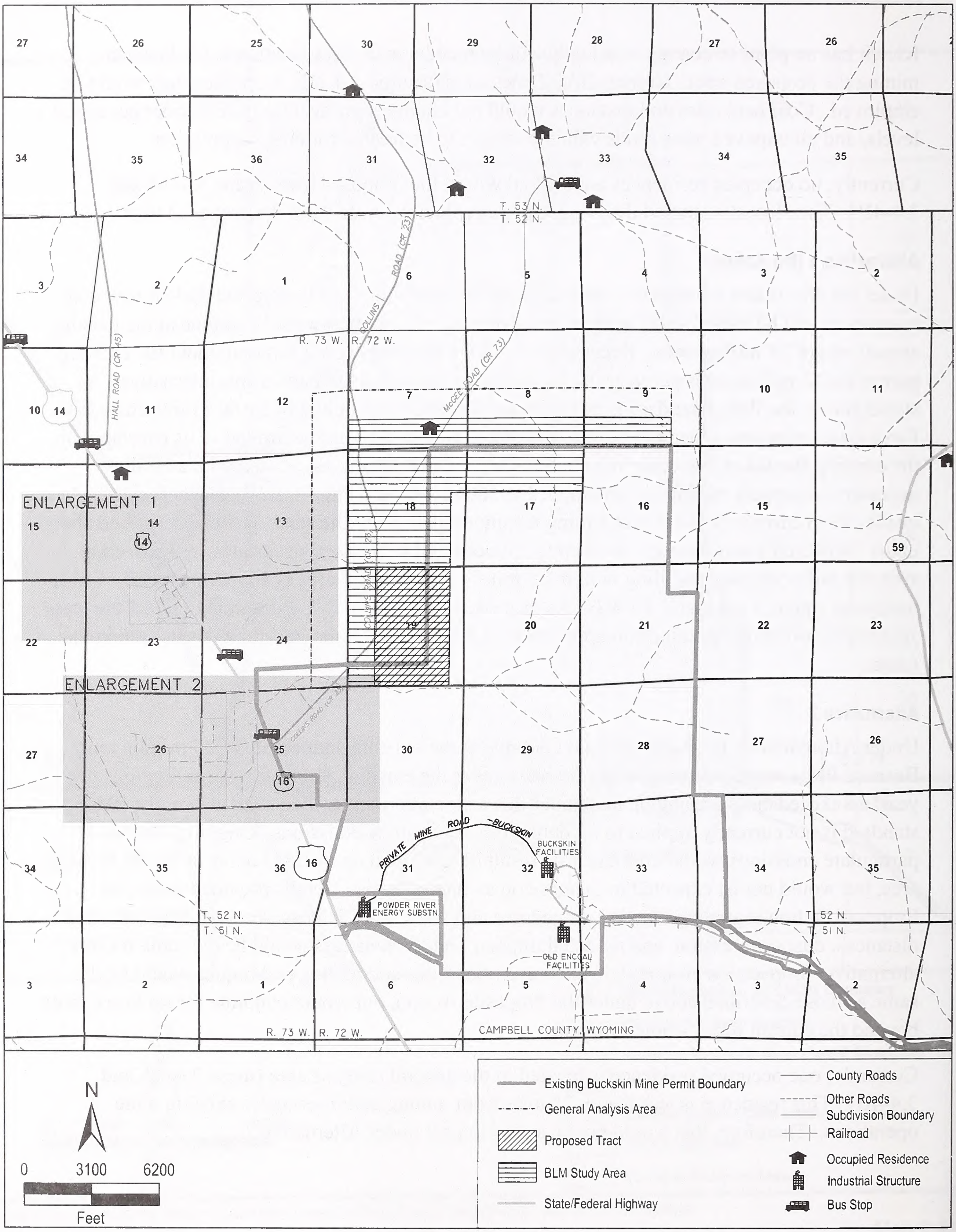
Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Production would continue at the existing annual rate of 25 million tons. Because PM_{10} exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this alternative. As stated above, the $PM_{2.5}$ standard is not currently applied to modeling of surface mine emissions. Particulate emissions generated in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would be associated with activities necessary to support mining on existing leases, described in section 1.1.3.3. Impacts on air quality from current facilities and mining techniques would be the same as those described above under "Affected Environment." Currently, no occupied residences are located in the overlap area; the only occupied dwelling within 1.5 miles of the overlap area is approximately 0.25 mile northwest (maps 3.4-4A and 3.4 4B). As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, production would continue at the existing annual rate of 25 million tons. Because PM_{10} exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this action alternative. As stated above, the $PM_{2.5}$ standard is not currently applied to modeling of surface mine emissions. Ongoing sources of particulate emissions would continue as a result of mining in up to 1,883 acres of the BLM study area, but would not be expected to increase on an annual basis. Details provided under the Proposed Action regarding blasting procedures and sizes, BACT measures, coal haul rates and distances, dust suppression, and modeled impacts and exceedances would be the same for this alternative. Impacts on air quality from current facilities and mining techniques would be the same as those described above under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

Currently, one occupied residence is located in the general analysis area (maps 3.4-4A and 3.4-4B). This residence is less than 0.25 mile from mining activities under existing mine operations. Therefore, this would not be a new impact under Alternative 2.



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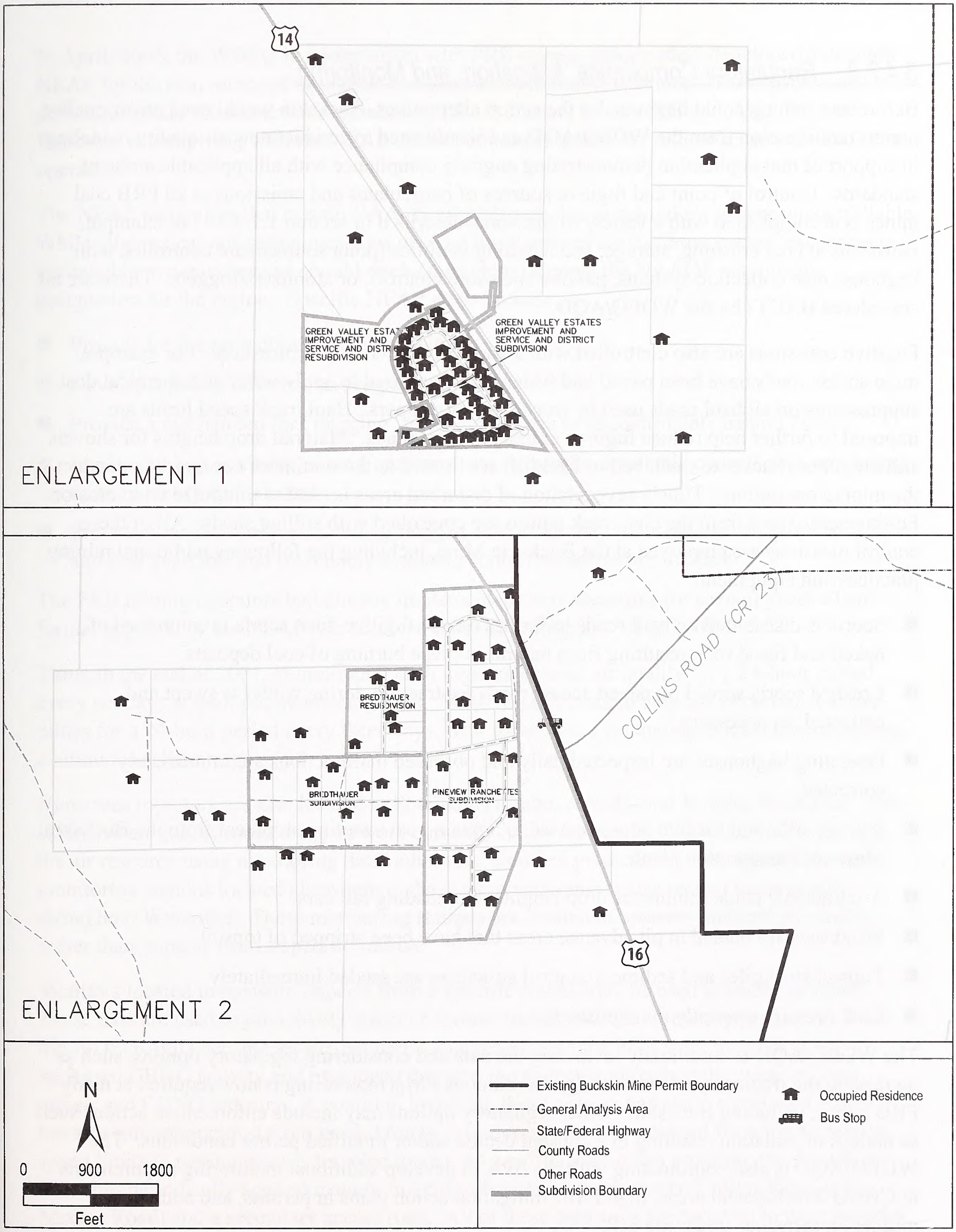
Map 3.4-4A
Roads, Highways, Occupied Dwellings, Businesses, and School Bus Stops in the Vicinity of the General Analysis Area



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Map 3.4-4B

Enlargement—Roads, Highways, Occupied Dwellings, Businesses, and School Bus Stops in the Vicinity of the General Analysis Area

3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring

Before any mining could begin under the action alternatives, Buckskin would need an air quality permit modification from the WDEQ/AQD and would need to conduct new air quality modeling in support of that application demonstrating ongoing compliance with all applicable ambient standards. Control of point and fugitive sources of particulates and emissions at all PRB coal mines is accomplished with a variety of measures described in section 1.1.3.3. For example, emissions at coal crushing, storage, and handling facilities (point sources) are controlled with baghouse dust collection systems, passive enclosure controls, or atomizers/foggers. These are all considered BACTs by the WDEQ/AQD.

Fugitive emissions are also controlled with a variety of other BACT measures. For example, mine access roads have been paved and water trucks are used to apply water and chemical dust suppressants on all haul roads used by trucks and/or scrapers. Haul truck speed limits are imposed to further help reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely revegetation of disturbed areas is used to minimize wind erosion. Fugitive emissions from the coal truck dumps are controlled with stilling sheds. All of these control measures are employed at the Buckskin Mine, including the following additional mining practices and equipment.

- Scoria is distributed on haul roads to further reduce fugitive dust; scoria is comprised of baked and fused rock resulting from natural in-place burning of coal deposits.
- Crushed scoria spread on paved access roads for traction during winter is swept and collected, as necessary.
- Operating baghouses are inspected daily and observed malfunctions are immediately corrected.
- Storage silos and loadout silos are used to contain coal awaiting shipment from the Buckskin Mine coal preparation plant.
- A retractable chute minimizes drop height when loading rail cars.
- Windrows are bladed in pit advance areas that have been stripped of topsoil.
- Topsoil stockpiles and sediment-control structures are seeded immediately.
- Coal fires are promptly extinguished.

The WDEQ/AQD is continually reviewing the data and considering regulatory options, such as increasing the frequency of monitoring. Continuous PM_{10} monitoring is now required at many PRB mines, including Buckskin. Other regulatory options may include enforcement actions such as notices of violation resulting in a consent decree and/or modified permit conditions. The WDEQ/AQD is also coordinating with the EPA to develop additional monitoring requirements in CBNG development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the SIP.

In April, 2006, the WDEQ in a joint effort with PRB mining stakeholders developed a detailed NEAP for the coal mines of Campbell and Converse counties, Wyoming. The NEAP was developed under the framework afforded by EPA's Natural Events Policy of May 30, 1996. Buckskin is complying with the NEAP developed jointly by the WDEQ/AQD and the PRB coal operators.

The NEAP recognizes that certain NAAQS exceedances due to natural events are uncontrollable. While all practical mitigation measures need be implemented during those events, exceedances attributable to natural events should not be considered against the NAAQS attainment designation for the region. Specific NEAP goals include:

- Provide for the protection of public health.
- Develop a public information program.
- Provide a mechanism for "flagging" exceedances due to uncontrollable natural events.
- Implement best available control measures and reasonably available control measures based on the severity of the event.
- Provide a mechanism for excluding flagged data when they meet specific wind speed criteria and best available and reasonably available control measures are in place.

The PRB mining operators had already implemented these measures for several years when formal approval of the NEAP was received from EPA Region VIII in 2007.

Through the end of 2001, at minimum, each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites. More recently, monitoring has occurred at active mines for a 24-hour period every three days, with some mines (including Buckskin) conducting continuous monitoring.

Numerous monitors are also located in Sheridan, Gillette, Arvada, and Wright, Wyoming. The extensive air quality monitoring network currently in use enables the WDEQ/AQD to manage the air resource using monitoring data rather than modeled predictions. The agency also uses monitoring stations located elsewhere in the state to anticipate issues related to air quality throughout Wyoming. These monitoring stations are located to measure ambient air quality rather than impacts from a specific source.

Monitors located to measure impacts from a specific source may be used to establish trends. These data are used to proactively arrest or reverse trends towards air quality problems. When the WDEQ/AQD became aware that particulate readings in the PRB were increasing due to increased CBNG activity and prolonged drought, the agency approached the counties, coal mines, and CBNG industry. A coalition involving those entities has made significant efforts towards minimizing dust from graded roads. Measures taken have ranged from implementing speed limits to paving heavily traveled roads. As a participant in this program, the Buckskin Mine has periodically applied magnesium chloride to two county roads (Collins Road and McGee Road) and a secondary access road. All of these measures are believed to have reduced the impacts of nearby, non-mining activity on Buckskin's monitors.

Monitoring is also used to measure compliance. When monitoring shows that any standard has been violated, the WDEQ/AQD can take a range of enforcement actions to remedy the situation. Where a standard is exceeded specific to an operation, the enforcement action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

3.4.3 Emissions of Nitrogen Oxides and Ozone

3.4.3.1 Affected Environment

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_x. One type of NO_x is NO_2, a reddish-brown gas that is heavier than air and has a pungent odor. NO_2 is by far the most toxic of this group and can combine with atmospheric moisture to form nitric acid and nitric oxide. Because several NO_x species can be chemically converted to NO_2 in the atmosphere, NO_2 emissions control is focused on all NO_x gases, while the ambient standard is expressed in terms of NO_2.

NO_x forms when fuel is burned at high temperatures either naturally or by human activities. The primary direct source of NO_x emissions during coal mining operations is tailpipe emissions from mining equipment and other vehicle traffic inside the mine permit area. Blasting that is done to remove overburden can result in emissions of several products, including NO_2, because of the incomplete combustion of explosives used in the blasting process. When this occurs, gaseous, orange-colored clouds may be formed, and they can drift or be blown off mine permit areas. The rate of release is not well known but is believed to depend on a wide number of factors which include, but are not necessarily limited to: downhole confinement; downhole moisture; type/blend of ammonium nitrate, fuel oil, and emulsion; and detonation velocity.

Various compounds and derivatives in the NO_x family, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide, may cause a wide variety of health and environmental impacts. According to the EPA (EPA 2007a), the following are the main causes of concern with respect to NO_x:

- It is one of the main precursers involved in the formation of ground-level 0_3, which can trigger serious respiratory problems.
- It reacts to form nitrate particles, acid aerosols, as well as NO_2, which also cause respiratory problems; and affects air quality related values (AQRVs) of visibility and deposition.
- It contributes to the formation of acid rain.
- It contributes to nutrient overload that deteriorates water quality.
- It contributes to atmospheric particles that cause visibility impairment, most noticeably in national parks.
- It reacts to form toxic chemicals.
- Nitrous oxide is a greenhouse gas that contributes to climate change.

- It can be transported over long distances.

That agency also associates the following severe health risks specifically with NO_2 (EPA 2001a):

- It may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin.
- Acute exposure may cause death by damaging the pulmonary system.
- Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections.

Potential health risks associated with inhalation of ground-level 0_3 and NO_x related particles include acute respiratory problems, aggravated asthma, decreases in lung capacity in some healthy adults, inflammation of lung tissue, respiratory-related hospital admissions and emergency room visits, and increased susceptibility to respiratory illnesses, including bronchitis and pneumonia (EPA 2007b). The WDEQ/AQD has received no reports of public exposure to NO_2 from blasting activities conducted at the Buckskin Mine. Therefore, the agency has not required Buckskin to implement any specific measures to control or limit public exposure to NO_2 from blasting, such as restrictions regarding blasting size, setbacks, or other parameters.

Although no NAAQS or WAAQS regulate short-term NO_2 levels, concern does exist about the potential health risk associated with short-term exposure to NO_2 from blasting emissions. The National Institute for Occupational Safety and Health (NIOSH) (NIOSH 2005), the Occupational Safety and Health Administration (OSHA) and the EPA have identified the following short-term exposure criteria for NO_2:

- NIOSH's recommended "immediately dangerous to life and health" level is 20.0 parts per million (37,600 $\mu g/m^3$).
- EPA's "significant harm" level, a 1-hour average, is 2.0 parts per million (3,760 $\mu g/m^3$).
- OSHA's "short-term exposure limit," a 15-minute time weighted average, which was developed for workers, is 5.0 parts per million (9,400 $\mu g/m^3$, which must not be exceeded during any part of the workday, as measured instantaneously).
- NIOSH's recommendation for workers is a limit of 1.0 parts per million (1,880 $\mu g/m^3$) based on a 15-minute exposure that should not be exceeded at any time during the workday.
- EPA recommends that concentrations not exceed 0.5 parts per million (940 $\mu g/m^3$) for a 10-minute exposure to protect sensitive members of the public (EPA 2003a).

A study conducted by Dr. Edward Faeder for the Black Thunder Mine recommended a limit of 5.0 parts per million (9,400 $\mu g/m^3$) for a 10-minute exposure.

According to EPA, "The exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001a).

Many mines in the PRB have implemented procedures aimed at reducing the amount of NO_x, particularly NO_2, released from the incomplete combustion of blasting agents; blasting NO_x is most often associated with cast blasting, which is used at larger mines with dragline operations. Because blast clouds are of a short-term, transient nature, the level of short-term exposure deemed to be "safe" is unknown. While this issue remains the subject of great debate, it should be noted that neither the EPA nor WDEQ/AQD has established NAAQS for NO_2 for averaging times shorter than one year. Despite extensive expert testimony provided to the Wyoming Environmental Quality Commission during hearings conducted in 2002 that argued for the establishment of a de facto "standard" ranging from 0.5 to 5.0 parts per million for a 10-minute exposure, the agency determined that insufficient evidence was available to establish a short-term exposure limit and concluded that additional study was required.

On the order of the Director of the WDEQ, members of the mining industry in the PRB conducted a comprehensive, multi-year monitoring and modeling study of NO_2 exposures from blast clouds. Based on results from that study (Thunder Basin Coal Company 2002) and supplemental data collected at the Buckskin Mine and elsewhere in the PRB, a series of "safe" setback curves for coal, overburden, and cast shots for various wind speed classes was derived from the sampled data, conservative projections of concentrations at greater/lesser distances than measured, and an assumed safe level (based on a comprehensive review of available health effects data) of 5.0 parts per million for 10 minutes. Appendix F provides additional details about this study and the data collection process.

Thus, while disagreement still exists regarding acceptable exposure levels, a large amount of actual data is now available from which informed decisions can be made regarding blasting practices. Regardless of the outcome of the debate on the allowable exposure level, the data show clearly that reduction in blast size and increases in setback distances are effective methods for mitigating the frequency and extent of public exposures.

Public exposure to emissions caused by surface mining operations is most likely to occur along public roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. Sources of fugitive NO_x emissions at the Buckskin Mine include the tailpipe emissions from the mining equipment, emissions from the trains used to haul the coal from the mine, and blasting the overburden and coal to facilitate excavation. As described in section 1.1.3.3, the Buckskin Mine does not use cast blasts to move overburden, though other blasting techniques are used in this process. Although all blasting methods have some potential for NO_x emissions, cast blasts are the most likely source. No NO_x point sources occur at the mine.

The WDEQ/AQD has determined that an assessment of annual NO_x impacts must be included as part of an air quality permitting analysis for new surface coal mines and existing mine plan revisions. The potential NO_x emissions related to mining operations at the existing Buckskin Mine are described in the air quality permit application submitted to the WDEQ/AQD in June 2006; the purpose of the permit revision request was described in section 3.4.2.1.

NO_x modeling was conducted in support of that June 2006 air permit application. Mining sources of NO_x were modeled as fugitive emissions from the areas where mining activities were projected to occur at Buckskin and the other five mines in the northern PRB. These included the overburden and coal blasting emissions, mobile emissions, and stationary emissions described in section 3.4.1.3. Regional sources of NO_x were also modeled, including local power plants, gas compressor stations, railroads, highways, and the City of Gillette. Individual and combined impacts from Buckskin, the other northern mines, and regional sources were evaluated at all model receptors. These receptors were placed around the perimeter of the northern group of mines and outward in a rectangular grid with 500-meter spacing. The extent of the receptor grid was sufficient to encompass the area of significant NO_x impact from the Buckskin Mine (1.0 $\mu g/m^3$ or more).

NO_2 impacts were derived by multiplying modeled NO_x concentrations by 75% and adding a background NO_2 concentration of 14 $\mu g/m^3$. This approach followed 40 CFR Part 51, Section 6.2.3, appendix W of the EPA's Guideline on Air Quality Models. The background NO_2 concentration was based on WDEQ/AQD guidance and ambient NO_x monitoring results at the Foundation Coal's Belle Ayr Mine in 2001 and 2002; that mine is approximately 20 miles southeast of the Buckskin Mine. Additional descriptions of the modeling process for this analysis is provided in appendix F.

Maximum annual NO_2 impacts (including regional sources and background concentration) at any model receptor of 38.0 $\mu g/m^3$ and 37.8 $\mu g/m^3$ were predicted in 2011 and 2012 respectively. Both of those values were considerably lower than the annual NO_2 NAAQS of 100 $\mu g/m^3$. At the model receptor where these predicted maximum values were calculated, Buckskin's contributions were estimated at 1.6 $\mu g/m^3$ in 2011 and 1.8 $\mu g/m^3$ in 2012. This receptor is located in an area impacted primarily by neighboring mines. A background NO_2 concentration of 14 $\mu g/m^3$ was assumed based on WDEQ/AQD guidance and ambient NO_x monitoring results at the Belle Ayr Mine in 2001 and 2002. Maps 3.4-2 and 3.4-3 show maximum modeled impacts at the Buckskin Mine boundary receptors of 35.6 $\mu g/m^3$ and 35.7 $\mu g/m^3$ in 2011 and 2012, respectively. Because modeled impacts from the worst-case years fall well below the NAAQS, the NO_2 NAAQS will be protected throughout the life of the mine.

O_3 has the same chemical structure whether it occurs miles above the earth or at ground-level and can be "good" or "bad," depending on its location in the atmosphere. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_x and volatile organic compounds that help form O_3. In the earth's lower atmosphere, ground-level O_3 is considered "bad." Ground-level O_3 is the primary constituent of smog. Sunlight and hot weather cause ground-level O_3 to form in harmful concentrations in the air. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of "bad" O_3, but even rural areas are also subject to increased O_3 levels because wind carries O_3 and the pollutants that form it hundreds of miles away from their original sources.

Under the CAA, the EPA has set protective health-based standards for O_3 in the air we breathe. Prior to May 27, 2008, the NAAQS 8-hour standard for O_3 was 0.080 parts per million

(157 μg/m^3). On March 27, 2008 (effective May 27, 2008) the EPA revised the 8-hour standard to 0.075 parts per million (147 μg/m^3). The WDEQ/AQD does not require O_3 monitoring at the Buckskin Mine, but levels have been monitored at WDEQ/AQD operated and maintained ambient air quality monitor sites in the PRB since 2001 (appendix F). An exceedance of the O_3 8-hour standard occurs if the 4th-highest daily maximum value is above the level of the standard (0.08 parts per million prior to 2008 and 0.075 parts per million since 2008). No exceedances of the O3 standard have occurred at either of the two monitoring sites when evaluated under the standard in place at the time the values were recorded.

3.4.3.2 Environmental Consequences

Proposed Action

Under the Proposed Action, production would continue at the existing annual rate of 25 million tons. Because NO_x exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this alternative. Ongoing sources of short-term NO_x emissions would continue as a result of mining the proposed tract, but would not be expected to increase on an annual basis. Impacts on air quality from current mining equipment and techniques would be the same as those described above under "Affected Environment," but would continue for up to two years beyond the current life-of-mine estimate.

Kiewit has no plans to change blasting procedures or sizes (section 1.1.3.3) when mining the proposed tract. Current control and notification measures for NO_x emissions (section 3.4.3.3) would continue to be employed.

Currently, no occupied residences are located within the proposed tract (maps 3.4-4A and 3.4-4B). The closest dwellings are more than 0.5 mile from the proposed tract.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Production would continue at the existing annual rate of 25 million tons. Because NO_x exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this alternative. Sources of NO_x emissions (e.g, vehicles, blasting [not cast-blasting]) in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would be associated with activities necessary to support mining on existing leases, described in section 1.1.3.3. Impacts on air quality from current facilities and mining techniques would be the same as those described above under "Affected Environment." Currently, no occupied residences are located in the overlap area; the only occupied dwelling within 1.5 miles of the overlap area is approximately 0.25 mile northwest (maps 3.4-4A and 3.4 4B). As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, production would continue at the existing annual rate of 25 million tons. Because NO_x exceedances were not forecast under the existing permit for 42 million tons per year, no exceedances are anticipated under this action alternative. Ongoing sources of short-term NO_x emissions would continue as a result of mining in up to 1,883 acres of the BLM study area, but would not be expected to increase on an annual basis. Impacts on air quality would be the same as those described above under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

Details provided under the Proposed Action regarding blasting procedures and sizes, BACT measures, coal haul rates and distances, dust suppression, and modeled impacts and exceedances would be the same for this alternative. Kiewit has no plans to change blasting procedures or sizes associated with the mining in the BLM study area. Current control and notification measures for NO_x emissions would continue to be employed.

Currently, one occupied residence is located in the general analysis area (maps 3.4-4A and 3.4-4B). This residence is less than 0.25 mile from mining activities under existing mine operations. Therefore, this would not be a new impact under Alternative 2.

3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring

Before any mining of the proposed tract could begin, the Buckskin Mine would need an air quality permit modification from the WDEQ/AQD and would need to conduct new air quality modeling in support of that application demonstrating ongoing compliance with all applicable ambient standards.

As described in section 3.4.3.2, the WDEQ/AQD has received no reports of public exposures to NO_2 from blasting activities conducted at the Buckskin Mine; therefore, the agency has not required the mine to implement any specific measures to control or limit public exposure to mine emissions. Additionally, the mine does not use cast blasts to move overburden; that is the most common source of the NO_2 clouds of greatest concern to local residents. Nevertheless, Buckskin has voluntarily committed to employ a variety of notification and control measures associated with blasting emissions in a good faith effort to keep the public informed of blasting activities. Several other surface coal mines in the PRB use similar voluntary blasting notification and control measures to avoid NO_2 impacts on the public.

Voluntary measures that have been instituted at Buckskin (and other mines), particularly when large blasts are planned, include:

- notifying neighbors by telephone (both private parties and other mining operations) in the general area of the mine prior to large blasts;
- monitoring weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible;

- posting signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;
- closing public roads that enter the general mine area, depending on wind conditions and blast location with respect to the road; and
- providing post-blast notification to neighbors of potential exposure to the blasting cloud.

The WDEQ/AQD has required several mines, including the neighboring Eagle Butte and Wyodak mines (map 1-1), to stop traffic on adjacent state and U.S. highways during blasting due to concerns with fly rock and the "startle factor." The agency does not require the Buckskin Mine to stop traffic because the blasting area does not affect any major public roads.

NO_2 was monitored in Gillette from 1975 through 1983. Because of public concerns about NO_2 emissions from blasting (particularly cast blasts) and a general concern by the WDEQ/AQD about levels of NO_x from all types of development in the PRB, the coal mining industry instituted a monitoring network in cooperation with the agency to gather data on those emissions beginning in 2001. Additional monitoring was conducted throughout the PRB from 2003 to 2006. Details regarding funding and ownership of the coal monitoring program are provided in appendix F.

The results of the most recent NO_x monitoring are summarized in table 3.4-4. The results indicate annual average NO_2 concentrations at all sites are well below the NAAQS of 100 $\mu g/m^3$ (table 3.4-1). The WDEQ/AQD and respective mines maintain these monitoring stations, and the agency relies on the ongoing monitoring data and emission inventories in air quality permit applications to demonstrate compliance with the annual NO_2 ambient air standard.

Table 3.4-4. Annual Ambient NO_2 Concentration Data ($\mu g/m^3$)

Year	Antelope Mine	Belle Ayr Mine	Thunder Basin National Grassland	Campbell Co.	Tracy Ranch
2003	7.5	13.2	5.6	13.2	
2004	2.9	10.3	3.8	9.4	5.5
2005	5.5	9.5	8.4	7.5	7.2
2006	5.1	14.4	8.1	5.7	11.2
2007			3.8	7.5	6.9

$\mu g/m^3$ = micrograms per cubic meter; NO_2 = nitrogen dioxide
Source: EPA 2009a

3.4.4 Visibility

Visibility refers to the clarity with which scenic vistas and landscape features are perceived at great distances. Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. $PM_{2.5}$ is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the farthest distance from which a person can see a

landscape feature. Without the effects of human-caused air pollution, a natural visual range is estimated to be about 140 miles in the western part of the U.S. and 90 miles in the eastern part (EPA 2001b). Presently, the visibility conditions monitored in the Bridger Wilderness Area are among the best in the U.S.

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's regional haze rule to achieve the national visibility goal. This goal was established as part of the CAA to prevent any future, and remedy any existing, impairment of visibility in mandatory federal class I areas that result from human-caused air pollution. The dv index is a scale related to visual perception that has a value near zero for a pristine atmosphere. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment.

3.4.4.1 Affected Environment

Air quality related values, including the potential air pollutant effects on visibility, are applied to PSD Class I (e.g., national parks) and Class II (areas outside designated Class I zones) areas; those classifications are described in section 2.3 of appendix F. The land management agency responsible for the Class I area (most restrictive) sets a limit of acceptable change for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3.4-5 shows approximate distances and directions from the general analysis area to 31 PSD Class I and sensitive Cass II areas in the vicinity of the PRB.

Table 3.4-5 Distances and Directions from the General Analysis Area to Sensitive Air Quality Areas

	Distance (miles)	Direction to Receptor
MANDATORY FEDERAL PSD CLASS I AREA		
Badlands Wilderness Area[1]	165	ESE
Bridger Wilderness Area	225	WSW
Fitzpatrick Wilderness Area	215	WSW
Gates of the Mountain Wilderness Area	343	NW
Grand Teton National Park	265	WSW
North Absaroka Wilderness Area	210	WNW
Red Rocks Lake Wilderness Area	307	W
Scapegoat Wilderness Area	393	NW
Teton Wilderness Area	237	WSW
Theodore Roosevelt National Park (North Unit)	242	NNE
Theodore Roosevelt National Park (South Unit)	196	NNE
U.L. Bend Wilderness Area	287	NW
Washakie Wilderness Area	215	WSW
Wind Cave National Park	123	SE

	Distance (miles)	Direction to Receptor
Yellowstone National Park	236	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	252	N
Northern Cheyenne Indian Reservation	74	NNW
Federal PSD Sensitive Class II		
Absaroka-Beartooth Wilderness Area	219	WNW
Agate Fossil Beds National Monument	168	SSE
Bighorn Canyon National Recreation Area	137	WNW
Black Elk Wilderness Area	113	ESE
Cloud Peak Wilderness Area	81	W
Crow Indian Reservation	120	NW
Devils Towner National Monument	42	ENE
Fort Belknap Indian Reservation	316	NNW
Fort Laramie National Historic Site	164	SSE
Jewel Cave National Monument	117	ESE
Mount Rushmore National Memorial	112	ESE
Popo Agie Wilderness Area	208	SW
Soldier Creek Wilderness Area	197	SE

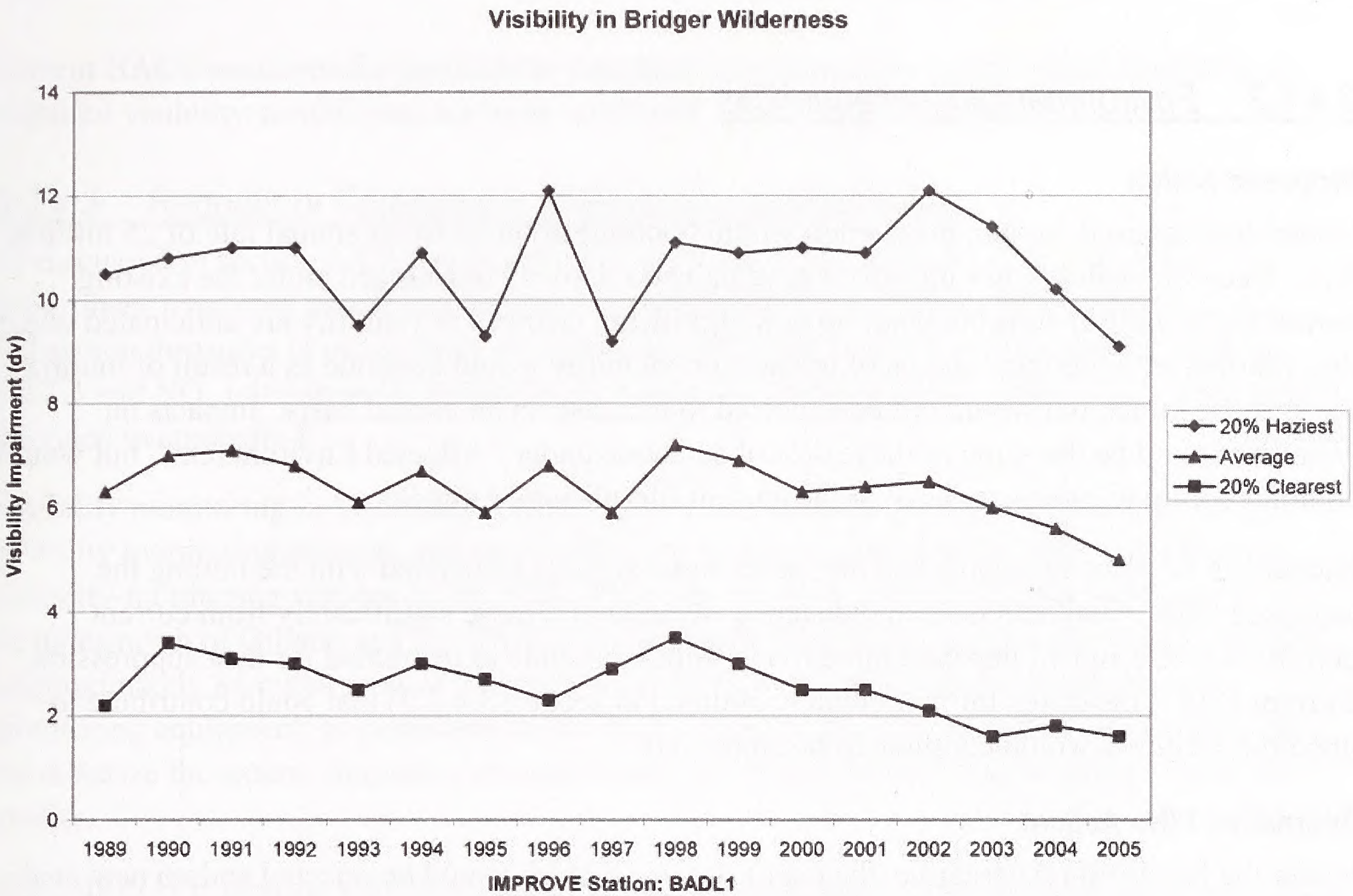
PSD = prevention of significant deterioration of air quality

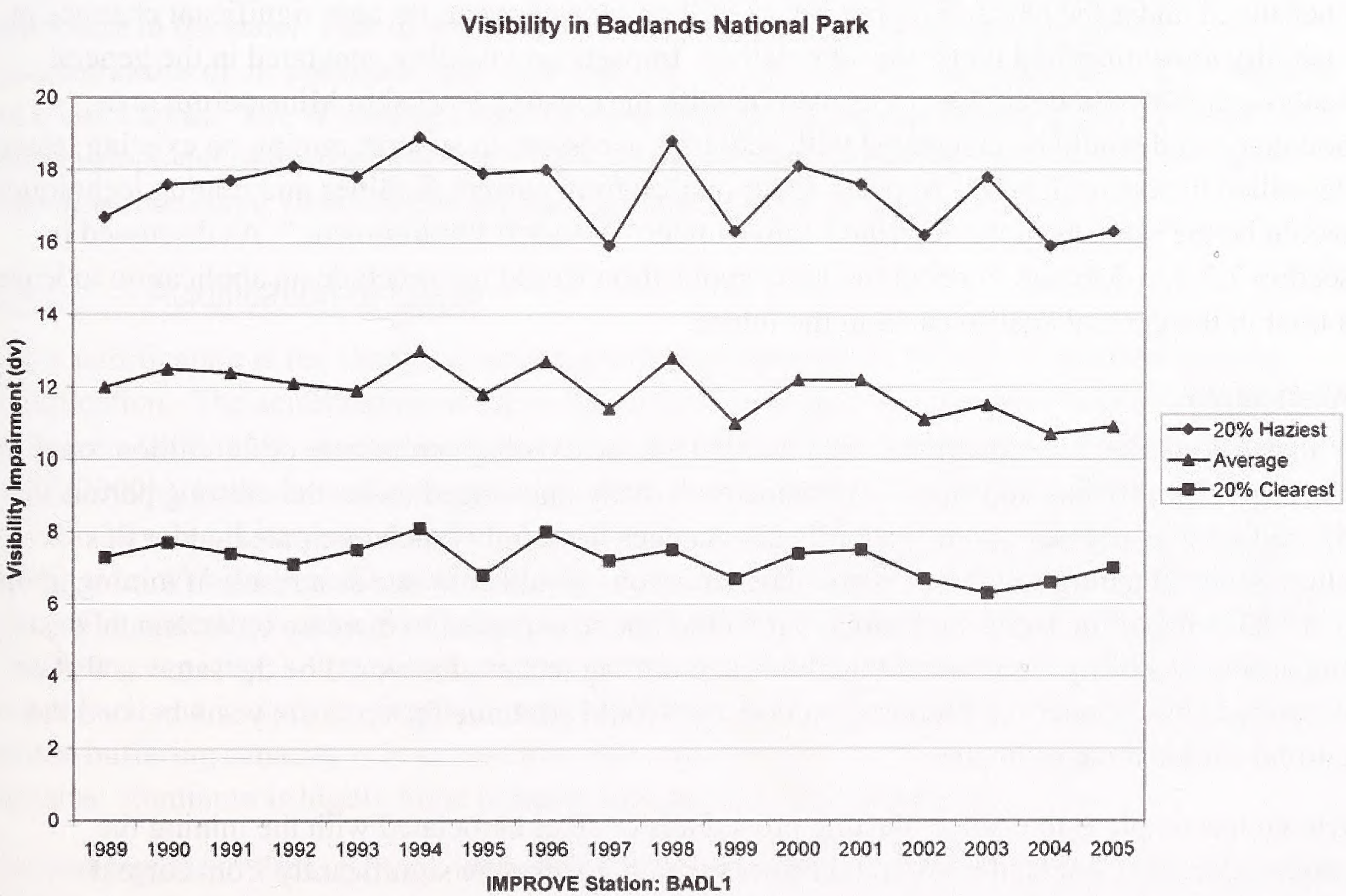
[1] The U.S. Congress designated the wilderness area portion of Badlands National Park as a mandatory federal PSD class I area. The remainder of Badlands National Park is a PSD class II area.

The regional haze rule calls for improved visibility on the most impaired days and no additional impairment on the least impaired days (EPA 1999). The EPA participates in the Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility monitoring program as part of its visibility protection program. The IMPROVE monitoring sites were established to be representative of all Class I areas. Figure 3.4-2 shows annual averages for the 20% best, average, and worst visibility days in the Badlands and Bridger wilderness areas from 1989 through 2005. To date, the Badlands National Park has statistically shown improved visibility on the least impaired days and no change in visibility on the average and most impaired days. The Bridger Wilderness Area has shown no statistically significant change in visibility on the least, average, or most impaired days (IMPROVE 2005).

The *Wyoming State Implementation Plan for Class I Visibility Protection* states "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the federal land managers have not identified any current impairment in the state's Class I areas due to such sources" (WDEQ/AQD 2003). The report is available at http://deq.state.wy.us/aqd/visibility.asp.

Surface coal mines are not considered to be major emitting facilities in accordance with the WDEQ/AQD Rules and Regulations (Chapter 6, Section 4). Therefore, State of Wyoming does not require mines to evaluate their impacts on class I areas, though the BLM does consider such issues during leasing.





o warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.4-2

Visibility in the Badlands National Park and Bridger Wilderness Area

3.4.4.2 Environmental Consequences

Proposed Action

Under the Proposed Action, production would continue at the existing annual rate of 25 million tons. Because visibility has improved or remained relatively unchanged under the existing permit for 42 million tons per year, no new significant changes in visibility are anticipated under this alternative. Ongoing sources of impacts on visibility would continue as a result of mining the proposed tract, but would not be expected to increase on an annual basis. Impacts on visibility would be the same as those described above under "Affected Environment," but would continue for up to two years beyond the current life-of-mine estimate.

Kiewit has no plans to change blasting procedures or sizes associated with the mining the proposed tract. Coal haul rates and distances would not change significantly from current permitted levels and all unpaved mine roads would continue to be treated for dust suppression. Current BACT measures for particulates (outlined in section 3.4.2.3) that could contribute to impaired visibility would continue to be employed.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Production would continue at the existing annual rate of 25 million tons. Because visibility has improved or remained relatively unchanged under the existing permit for 42 million tons per year, no new significant changes in visibility are anticipated under this alternative. Impacts on visibility generated in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would be associated with activities necessary to support mining on existing leases, described in section 1.1.3.3. Impacts on air quality from current facilities and mining techniques would be the same as those described above under "Affected Environment." As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, production would continue at the existing annual rate of 25 million tons. Because visibility has improved or remained relatively unchanged under the existing permit for 42 million tons per year, no new significant changes in visibility are anticipated under this alternative. Ongoing sources of particulate emissions would continue as a result of mining in up to 1,883 acres of the BLM study area, but would not be expected to increase on an annual basis. Impacts on visibility from current facilities and mining techniques would be the same as those described above under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

Kiewit has no plans to change blasting procedures or sizes associated with the mining the proposed tract. Coal haul rates and distances would not change significantly from current permitted levels and all unpaved mine roads would continue to be treated for dust suppression.

Current BACT measures for particulates (outlined in section 3.4.2.3) that could contribute to impaired visibility would continue to be employed.

3.4.4.3 Regulatory Compliance, Mitigation, and Monitoring

As discussed in section 3.4.2.1 and section 3.4.3.1, $PM_{2.5}$ is the main cause of visibility impairment from coal mining operations, with secondary impacts from NO_x emissions. Mitigation measures in use to limit emissions of particulate matter are discussed in section 3.4.2.3 and NO_x mitigation measures are discussed in section 3.4.3.3. Additional information is provided in appendix F.

Visibility monitoring in Wyoming consists of both the WDEQ/AQD-sponsored Wyoming visibility monitoring network and the IMPROVE program. The WDEQ/AQD has sited two visibility-monitoring stations in the PRB. The Thunder Basin National Grasslands site is 32 miles north of Gillette and the Cloud Peak Wilderness Area site is 14 miles west of Buffalo (approximately 84 miles west of Gillette). Both sites include a variety of sophisticated monitoring equipment, as described in section 3.0 of appendix F. These sites are being used to characterize the extent, frequency of occurrence, and magnitude of impairments to visual air quality.

The IMPROVE steering committee approved the incorporation of the Thunder Basin and Cloud Peak sites into the IMPROVE network in June 2002. Although these stations are not located in Class I areas, the collected data will be comparable to monitoring data available from such areas elsewhere in the state. This information can help scientists determine the types and concentrations of air pollutants and their direction of travel in order to project visibility impacts on Class I areas. The Wyoming visibility monitoring network was recently supplemented with the development of a website at http://www.wyvisnet.com/all.html to allow public access to real-time monitored visibility and air quality conditions (WDEQ/AQD 2005).

3.4.5 Acidification of Lakes

Lake acidification is the change in acid-neutralizing capacity, or the lake's capacity to resist acidification. The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). According to the EPA, SO_2 and NO_x are the main causes of acid rain (EPA 2009b); both elements are primarily derived from burning fossil fuels. Most lakes and streams have a pH between 6 and8 (on a scale of 1 to 14), although some lakes are naturally acidic even without the effects of acid rain. Acid rain primarily affects sensitive water bodies located in watersheds whose soils have a limited ability to neutralize acidic compounds (called "buffering capacity"). Lakes and streams become acidic (i.e., pH value goes below 7) when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. In areas where buffering capacity is low, acid rain also releases aluminum from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms.

Several regions in the U.S. were identified in a national surface water survey as containing many of the waters sensitive to acidification. They include the Adirondacks and Catskill mountains in

New York, the mid-Appalachian highlands along the east coast, the upper Midwest, and mountainous areas of the western U.S.

Scientists predict that the decrease in SO_2 emissions required by a nationwide acid rain program will significantly reduce acidification due to atmospheric sulfur. Without the reductions in SO_2 emissions, the proportions of acidic aquatic ecosystems would remain high or dramatically worsen (EPA 2005a). The USDA Forest Service has been monitoring air quality in the Wind River Mountain Range in Wyoming since 1984 and is seeing a general trend of decreasing sulfates. In contrast, nitrates have been increasing globally.

3.4.5.1 Affected Environment

AQRVs, including the potential air pollutant effects on the acidification of lakes and streams, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area in a particular region sets limits of acceptable change for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Lake acidification is expressed as the change inacid-neutralizing capacity, which represents the lake's capacity to resist acidification from acid rain. This unit of change is measured in microequivalents per liter. Table 3.4-6 shows the existing acid-neutralizing capacity monitored in some mountain lakes in Wyoming and their distance from the general analysis area. For comparison, the USDA Forest Service considers lakes with acid-neutralizing capacity values between 25 and 100 microequivalents per liter to be very sensitive to atmospheric deposition, and lakes with values less than or equal to 25 microequivalents per liter to be extremely sensitive to atmospheric deposition.

Table 3.4-6. Existing Acid-Neutralizing Capacity in Sensitive Lakes

Wilderness Area	Lake	Background Acid-Neutralizing Capacity (µeq/L)	Distance from General Analysis Area (miles)
Bridger	Black Joe	69.0	218
	Deep	61.0	243
	Hobbs	68.0	239
Cloud Peak	Upper Frozen	5.8[1]	82
	Emerald	55.3	89
	Florence	32.7	85
Fitzpatrick	Ross	61.4	250
Popo Agie	Lower Saddlebag	55.5	220

µeq/l = microequivalents per liter

[1] The background acid-neutralizing capacity is based on only six samples taken between 1997 and 2001

Source: Argonne (2002).

3.4.5.2 Environmental Consequences

Proposed Action

Under the Proposed Action, no significant impacts on lake acidification are expected due to the distances from the Buckskin Mine to sensitive lakes in the region (table 3.4-6). Production would continue at the existing annual rate of 25 million tons. Ongoing sources of impacts on lake acidification would continue as a result of mining the proposed tract. These impacts would not be expected to increase on an annual basis, but would continue for up to two years beyond the current life-of-mine estimate.

Impacts of coal mining on acid deposition are due primarily to NO_x emissions from mining operations, as discussed in section 3.4.3 above. Studies have demonstrated that lake acidification is a regional phenomenon (Dillon et al. 1978). Kiewit has no plans to change its coal production rates or operations, including blasting methods, hauling rates and distances, or other emissions sources. Operations at the Buckskin Mine will continue to employ current control and notification measures for NO_x emissions (outlined in section 3.4.3.3) to minimize the release of emissions into the atmosphere. Modeling for the current Buckskin Mine permit did not forecast any exceedances of the annual particulate or NO_2 NAAQS at the currently permitted production rate of 42 million tons per year that could further contribute to lake acidification; Buckskin's current and anticipated production rates are 25 million tons per year.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected, and no new coal reserves would be mined in the general analysis area. Production would continue at the existing annual rate of 25 million tons. Impacts on lake acidification in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would be associated with activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, no significant impacts on lake acidification are expected due to the distances from the Buckskin Mine to sensitive lakes in the region (table 3.4-6). Production would continue at the existing annual rate of 25 million tons. Ongoing sources of impacts on lake acidification would continue as a result of mining the final tract configuration. These impacts would not be expected to increase on an annual basis, but would continue for up to six years beyond the current life-of-mine estimate.

Kiewit has no plans to change its coal production rates or operations, including blasting methods, hauling rates and distances, or other emissions sources. Operations at the Buckskin Mine will continue to employ current control and notification measures for NO_x emissions (outlined in section 3.4.3.3) to minimize the release of emissions into the atmosphere. Modeling for the current Buckskin Mine permit did not forecast any exceedances of the annual particulate or NO_2 NAAQS at the currently permitted production rate of 42 million tons per year that could further

contribute to lake acidification; Buckskin's current and anticipated production rates are 25 million tons per year.

3.4.6 Regulatory Compliance, Mitigation, and Monitoring

Mitigation and monitoring for coal mine emissions, including the emissions that contribute to the acidification of lakes, are discussed in sections 3.4.2.3, 3.4.2.4, 3.4.3.3, and 3.4.3.4. Other air quality monitoring programs that are in place in the PRB include the Wyoming Air Resources Monitoring System which monitors sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and the National Atmospheric Deposition Program, which monitors precipitation chemistry in Newcastle.

3.4.7 Residual Impacts on Air Quality

No residual adverse impacts on air quality would occur following mining and reclamation.

3.5 Water Resources

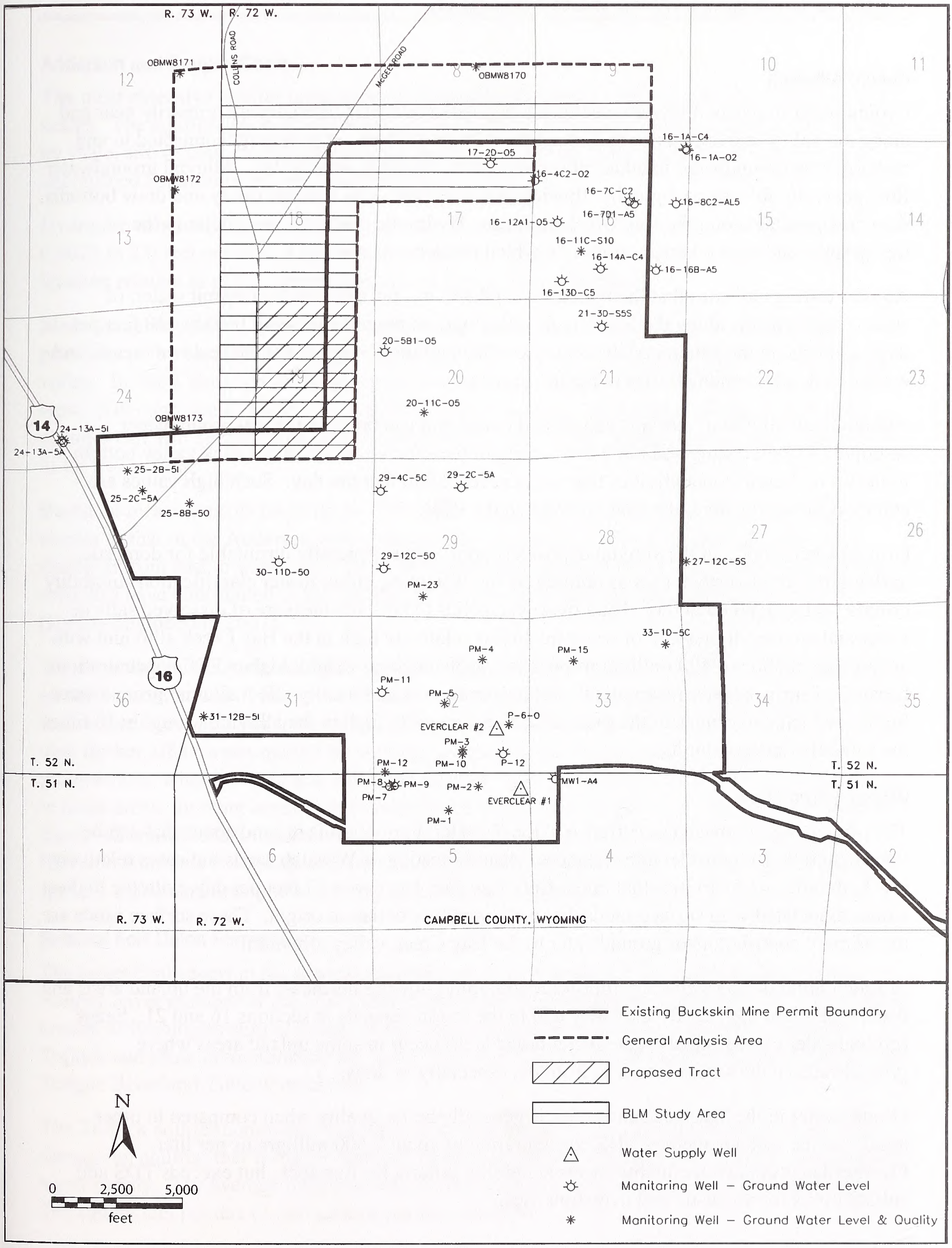
This section describes the affected environment as it relates to water resources in the general analysis area, and identifies potential impacts on water resources that would result from the Proposed Action and alternatives.

3.5.1 Groundwater

3.5.1.1 Affected Environment

Six water-bearing hydrologic units in the general analysis area could be disturbed by mining. In descending order, these units are recent alluvium, the Wasatch Formation, the Anderson coal seam, the Fort Union Formation interburden, and the Canyon coal seam. While the Anderson and Canyon coal seams belong to the Fort Union Formation geologically, they divide the Fort Union Formation into multiple distinct hydrologic sections. The interburden between the Anderson and Canyon coal seams exhibits very low permeabilities and has insufficient yield potential to be considered an aquifer; therefore, it will not be discussed here. The Fort Union Formation that underlies the Canyon coal will not be physically disturbed by mining activities but may be used for water supply.

Aquifer characterization in the general analysis area is based on more than 80 groundwater monitoring wells installed in and adjacent to the WDEQ/LQD permit area between 1980 and 2000 (map 3.5-1). These wells were installed in each of the primary geologic units: alluvium (recent stream-laid and slope-wash deposits), the Wasatch overburden, and the Anderson and Canyon coal seams. These geological units are discussed below.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.5-1

Currently Active Groundwater Monitoring and Water Supply Wells at Buckskin Mine

Recent Alluvium

Groundwater in recent alluvium (sediments deposited by water flow) occurs primarily near and along the valley and draw bottoms associated with Hay Creek. It is directly connected to and recharged by groundwater in adjacent scoria and the Wasatch overburden. Alluvial groundwater flow generally follows topography, flowing out of upland areas into the valley and draw bottoms, then down-valley along the Hay Creek drainage. Hydraulic gradients are similar to the topographic and valley-bottom slopes on which the deposits reside.

Aquifer testing indicates that the hydraulic conductivity, the capacity to transmit water, of stream-laid deposits along the Hay Creek valley bottom range from about 0.40 to 230 feet per day. Deposits in the general analysis area are finer-grained compared to those downstream, and exhibit hydraulic conductivities in the lower range.

Although not alluvium, scoria is considered recent and can be an important groundwater resource. Recent testing and mine dewatering of the scoria near the Hay Creek valley bottom indicates hydraulic conductivities that may exceed 2,000 feet per day. Such high values are common for scoria along the coal outcrops in the PRB.

Groundwater quality in the alluvial deposits is poor, and is generally unsuitable for domestic, agricultural, and livestock uses as defined by the Wyoming groundwater classification suitability criteria (WDEQ/WQD 2005). Total dissolved solids (TDS), the measure of dissolved salts in water and an overall measure of water quality, is relatively high in the Hay Creek alluvium with an average of about 4,500 milligrams per liter. Isolated areas exhibit higher TDS concentrations because of surface water reservoirs that concentrate salts and locally affect alluvial groundwater. Sulfate, which contributes to the overall TDS, is generally high in the alluvium, roughly 10 times the suitability criteria limit.

Wasatch Formation

The principal groundwater occurrence in the Wasatch Formation is in sandstones that can be traced laterally for considerable distances. Aquifer testing of Wasatch sands indicates relatively low hydraulic conductivities that range from less than 1 to about 13 feet per day, with the highest values associated with surface sands that are commonly eolian in origin. These surface sands are the primary contributors of groundwater to the Hay Creek valley alluvium.

Wasatch groundwater generally follows topography, flowing northeast from the upland areas and discharging into the Hay Creek valley and to the scoria deposits in sections 16 and 21. Seeps (groundwater emanating at grade over a broad area) occur in some upland areas where groundwater in the sandstones is near grade, especially in draws.

Groundwater in the Wasatch sandstones is generally better quality when compared to other aquifer units, with an average TDS concentration of about 2,500 milligrams per liter. Overburden groundwater quality meets suitability criteria for livestock, but exceeds TDS and sulfate limits for domestic and irrigation uses.

Anderson and Canyon Coals

The most extensive aquifer units in the general analysis area are the Canyon and Anderson coal seams. The aquifers are defined by the top and bottom of the seam, and are commonly confined by shale, silt, or clay. However, in some areas, groundwater in both seams may also occur in unconfined conditions and may even be unsaturated.

Hydraulic conductivities in the coal seams are generally low and exhibit a range of about 0.0020 to 2.0 feet per day. The variation is due to the degree to which the coal is fractured or its location relative to grade, which controls the degree of weathering.

Measurements taken in the 1980s showed that groundwater flow in the Anderson coal seam was primarily to the east and northeast from upland areas toward discharge zones in the Hay Creek valley. In 2000, some groundwater in the Anderson coal seam was found to flow from east to west. Although some changes in groundwater flow patterns are a result of mine dewatering, changes can also be attributed to CBNG operations west of the general analysis area that began in the mid-1990s.

Based on measurements taken in the 1980s, groundwater flow in the Canyon coal seam was similar to that of the Anderson coal seam (primarily to the northeast). In 2000, flows changed direction from east to west. As with the Anderson coal, in addition to mine dewatering, CBNG activities have contributed to the changes in groundwater flow patterns in the Canyon coal (Hydro-Engineering 2007).

Water quality in the Anderson and Canyon coal seams exhibits considerable variation depending on the concentrations of major dissolved constituents, and is dominated by calcium, magnesium, and sulfate. Groundwater in the overburden affects water quality in the coals. CBNG drawdown may further affect water quality by creating induced hydraulic gradients in the coals. Coal groundwater, where present and still unaffected by mining or CBNG, is suitable for livestock use in some areas. In other areas, it is unsuitable for livestock or irrigation use because of elevated dissolved constituents or sodium adsorption ratio, a measure of the effect of sodium on soils. Elevated ammonia is consistent in both coal seams where bicarbonate dominates the anionic species, a phenomenon typical for coal groundwater in general.

Subcoal Fort Union Formation

The target coal seams in the general analysis area occur within the uppermost portion of the Tongue River member of the Fort Union Formation. The underlying Lebo and Tullock members consist of lithologies similar to that of the Tongue River, with sandstone predominating the Tullock and shale predominating the Lebo. The Lebo is commonly a confining unit between the Tongue River and Tullock members.

The Tullock aquifer commonly exhibits transmissivity, the rate at which water is transmitted through an aquifer, that is higher than that of the Tongue River aquifer. This makes it a common water supply. The average transmissivity for this member as reported by the OSM (1984) is 290 square feet per day (2,200 gallons per day per foot).

Buckskin Mine uses two water supply wells completed in the Tullock aquifer south of the general analysis area (map 3.5-1). These wells supply water for both mining operations and on-site domestic use.

3.5.1.2 Environmental Consequences

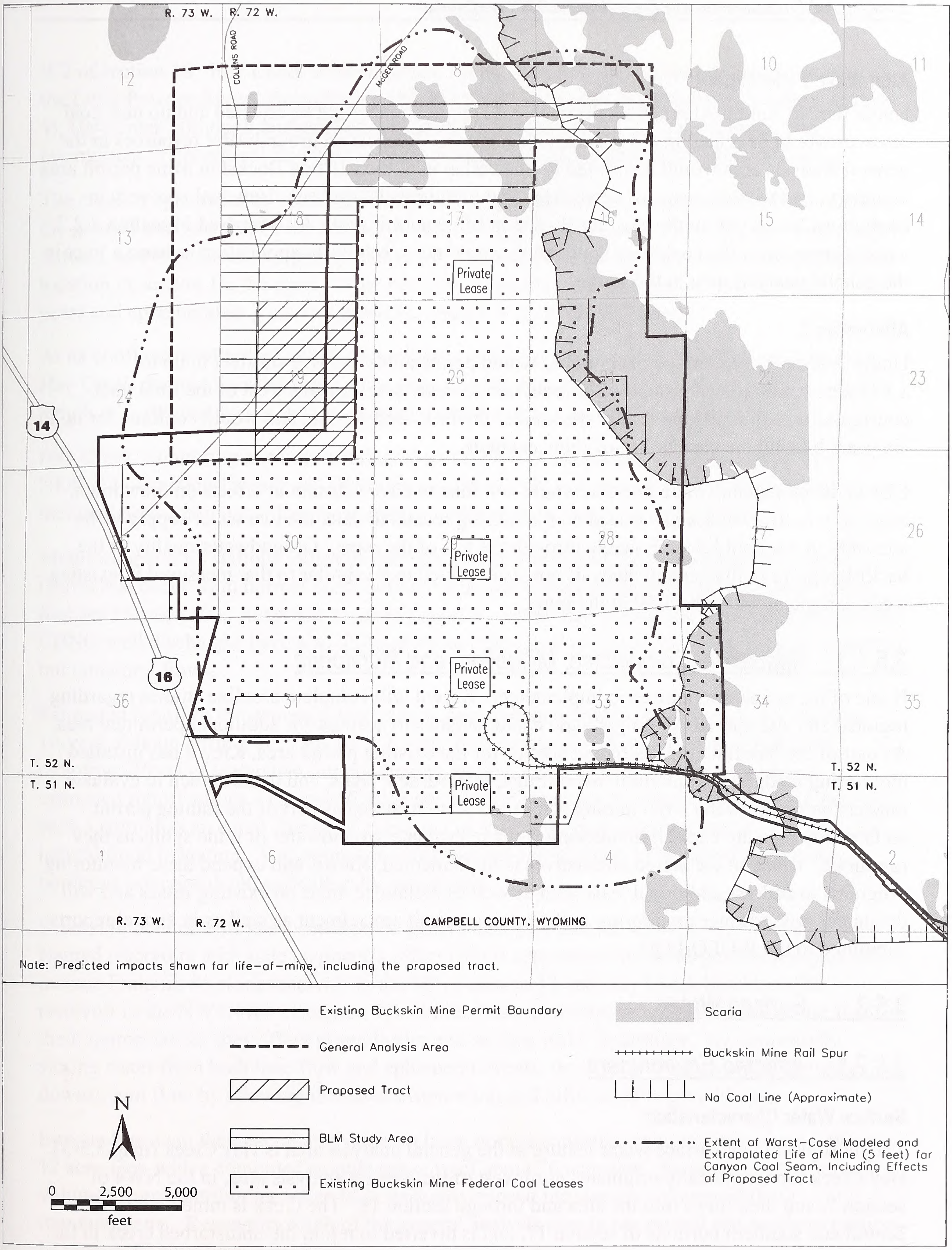
Proposed Action

Under the Proposed Action, surface coal mining would permanently remove aquifers in the proposed tract (419 acres). Additionally, the Proposed Action would cause a long-term reduction in groundwater in aquifers beyond the proposed tract as a result of seepage into and dewatering from mine excavations. This reduction in groundwater is referred to as drawdown. The extent of drawdown would depend on how long the mine excavations are open, the distance of the aquifers from the proposed tract, and the extent of dewatering. Map 3.5-2 illustrates the extent of drawdown under the Proposed Action, taking into account mining of existing leases. The extent of dewatering depends on aquifer transmissivity, storage capacity, and heterogeneity, as well as the period over which dewatering occurs. Drawdown would extend farther in clean Wasatch sands that exhibit a relatively high transmissivity than in less permeable materials. Dewatering through drawdown would also be most prevalent where these sands are laterally continuous. Drawdown patterns are more variable in aquifers that have more heterogeous sands, such as the Wasatch and Fort Union sands.

Aquifer drawdown extends farther and occurs in a more consistent manner in the Anderson and Canyon coal seams than in the overburden because the aquifers have more homogeneous characteristics. However, drawdown can be substantially affected by variations in hydrogeologic characteristics such as fracture density, proximity to crop lines, recharge potential from overlying units, and lateral continuity. Such variations have been observed at the Buckskin Mine and would be likely in the proposed tract. Therefore, drawdown in the coals away from the mine is expected to behave in a similar manner to that observed to date.

CBNG development, where present, would continue to have substantial effects on drawdown, especially in the coal seams. In the absence of CBNG development, drawdown typically is greatest near the mine, and decreases substantially away from the mine. Therefore, the Proposed Action would have greater impacts on near-mine groundwater resources than on those farther from the mine.

Two water supply wells from the underburden aquifer are currently used by the Buckskin Mine. Although the evaluation of adequate water supply is ongoing as mining progresses, the mine may not require additional underburden water supply wells to mine the proposed tract. If that is the case, the existing wells would continue to be used under the Proposed Action and presumably through the life of the mine. Due to its proximity to the existing Buckskin Mine, groundwater quality in the backfill aquifer on the proposed tract is expected to be similar to that measured in existing wells completed in the backfill at the mine. Variations in water quality may occur because of differences in the proportions of materials (i.e., sands, silts, and clays) used to reclaim the aquifer. Groundwater is expected to rise to similar levels as observed prior to mining, but varied groundwater levels, vertical hydraulic gradients, and perched aquifer zones would not occur to the same degree because of the more homogeneous nature of the backfill.



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Map 3.5-2

Extent of Drawdown under Proposed Action

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on groundwater resources in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of dewatering and withdrawals resulting from coal recovery in contiguous leases within the existing Buckskin Mine permit area. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining would permanently remove aquifers in up to 1,833 acres. Long-term groundwater reduction in near-mine aquifers west of the final tract configuration would extend farther than under the Proposed Action, and would continue for up to six years beyond the current life-of-mine estimate.

CBNG development, where present, would continue to have substantial effects on drawdown, especially in the coal seams. Based on monitoring results to date, the two water supply wells currently in use could remain viable through the life of the mine. Groundwater quality in the backfill aquifer in the general analysis area is expected to be similar to that measured in existing wells completed in the backfill at the mine.

3.5.1.3 Regulatory Compliance, Mitigation, and Monitoring

If one of the action alternatives is implemented, Kiewit will complete baseline studies regarding regional and site-specific hydrogeologic characteristics to account for additional permitted area. As part of the baseline hydrogeologic studies for the existing permit area, Kiewit has installed monitoring wells in the alluvium, overburden, interburden, coals, and underburden to evaluate impacts on groundwater from mining activities. Also installed as part of the mining permit reclamation plan are backfill monitoring wells to evaluate groundwater of mine spoils as they resaturate. If one of the action alternatives is implemented, Kiewit will expand these monitoring programs to address additional lease area as well as reclaimed areas on existing leases and will document groundwater monitoring in the mining permit amendment as well as in annual reports submitted to the WDEQ/LQD.

3.5.2 Surface Water

3.5.2.1 Affected Environment

Surface Water Characteristics

The most prominent surface water feature in the general analysis area is Hay Creek (map 3.5-3). Hay Creek topographically originates northwest of the general analysis area, in the NW4 of section 7, and then flows into the area and through section 18. The creek is mined out in the central and southern portions of section 17, and is diverted to rejoin the undisturbed creek in the

W2 of section 16. Hay Creek is considered a minor stream in the regional drainage network of the Little Powder River. According to WDEQ/WQD Rules and Regulations (Chapter 1 Section 4), Hay Creek, although unclassified, would be characterized as a class 4 stream having intermittent or ephemeral flow that is protected for agricultural uses and wildlife watering.

The creek is ephemeral in nature (i.e., responds only to rainfall or snow-melt events) as it enters the general analysis area in the SW4 of section 7. Down-valley of this location the valley bottom flattens, and Hay Creek is a poorly defined, ephemeral channel. Downstream of its undisturbed location in section 16, the creek varies between intermittent (i.e., flows for less than half of the year) and ephemeral as it courses eastward along a well-defined channel.

At its confluence with the Little Powder River, about 2 miles east of the general analysis area, Hay Creek drains 15 square miles. The channel elevation drops about 34 feet over a channel length of 8,100 feet across the area, equating to an average channel slope of 0.0042.

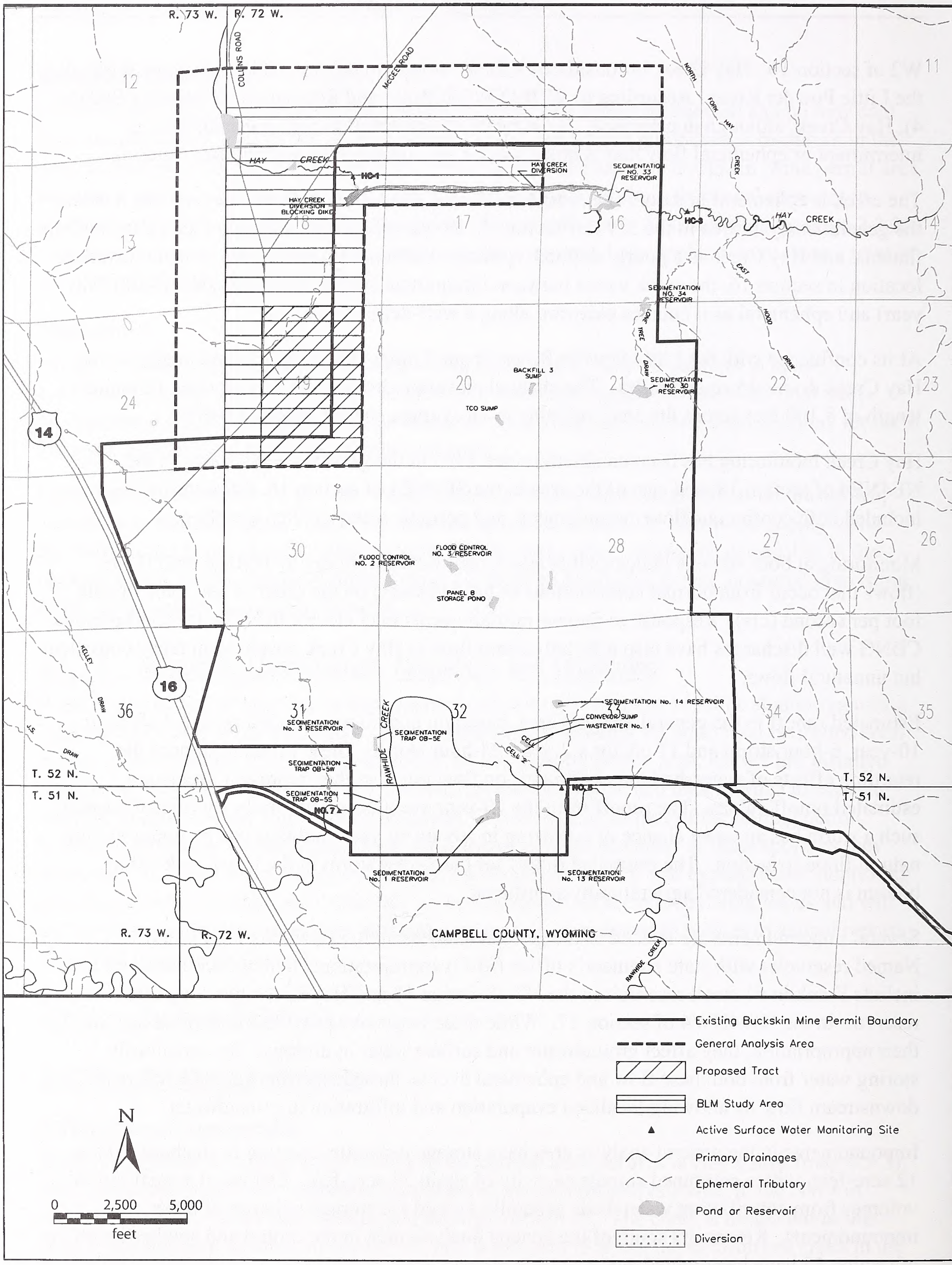
Hay Creek monitoring has been conducted since 1999 in the general analysis area in the NE4NE4 of section 18, and east of the area in the SE4NE4 of section 16. Monitoring has included both continuous flow measurements and periodic water quality sampling.

Monitoring at both stations indicates that Hay Creek varies from dry to average base flows (flows that occur from normal contributions of groundwater) on the order of less than 1 cubic foot per second (cfs). Response to intense rainfall events may elevate the flow for short periods. CBNG well discharges have also affected stream flow in Hay Creek, resulting in fairly consistent but unnatural flows.

Estimated runoff in the general analysis area, based on quantitative modeling, is 2.7 cfs for a 10-year, 6-hour storm and 17 cfs for a 2-year, 24-hour storm. These estimates ignore the retarding effects of watershed impoundments on flow rates, so they represent maximum estimated runoff values. The runoff from the 10-year event is agriculturally significant because such a storm has an equal chance of occurring in any given year, and thus can be important for natural flood irrigation. The estimated runoff for the 2-year storm in the Hay Creek valley bottom is not considered agriculturally significant.

Several impoundments are located in the general analysis area, in sections 17, 18, and 19. Named reservoirs with state engineer's office (SEO) appropriations in the general analysis area include Franklin #1 stock reservoir in the N2 of section 18 and Hay Creek blocking dike reservoir in the NW4NW4 of section 17. While these reservoirs provide a beneficial use for their appropriation, they affect groundwater and surface water hydrology. By temporarily storing water from both base flow and ephemeral events, these reservoirs generally decrease downstream flow by allowing localized evaporation and infiltration to groundwater.

Impoundments in the general analysis area have storage capacities ranging from about 0.90 to 12 acre-feet, with a combined storage capacity of about 26 acre-feet. Estimated annual runoff volumes from contributing watersheds generally exceed the storage volumes of these impoundments. Reservoirs south of the general analysis area in the central and southern portions of section 17 have been mined out.



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Map 3.5-3

Surface Water Features in the General Analysis Area

Several ephemeral channels in the general analysis area contribute drainage area to the Hay Creek valley. Three prominent, southeast-trending draws are located in sections 8 and 9, and two other prominent draws are located in sections 18 and 19.

Surface Water Quality

Monitoring at various locations along Hay Creek in the general analysis area indicates that water quality is poor. Water quality varies along the creek and is affected by in-channel impoundments that extend the amount time that the water is exposed to alluvial materials and concentrations of dissolved minerals through evaporation. Surface water quality has also been affected by CBNG discharges that contribute to apparent elevated sodium bicarbonate levels that are more characteristic of coal groundwater and not surface water in Hay Creek.

Water quality is generally acceptable for livestock most of the time. Elevated TDS, sodium adsorption ratio, manganese, and sulfate may exceed WDEQ suitability criteria for irrigation. Prior to mining in the northern portion of section 17, TDS downstream of McGee Reservoir was roughly double that at upstream locations primarily as a result of elevated calcium and magnesium sulfate.

3.5.2.2 Environmental Consequences

Proposed Action

Under the Proposed Action, coal mining would have significant temporary effects on surface water runoff characteristics in the proposed tract. Erosion and sediment discharge would likely increase in disturbed areas because of vegetation removal. Water flow and direction in that area would be altered by the removal and reconstruction of drainage channels prior to mining and from redirected flow through the use of erosion- and sediment-control structures to manage surface water runoff from disturbed areas. No connected water bodies cross the proposed tract, so no additional channel diversions are anticipated under the Proposed Action. Regardless of planned mining and reclamation activities, large storms that exceed capacity designs for sediment-control structures (typically a storm that would exceed the 10-year, 24-hour rainfall) could produce sediments that have impacts on areas downstream of mining operations.

Upon completion of reclamation, when soil structure and vegetation have been reestablished, surface water flow, quality, and sediment discharge would approximate premining conditions. Soil structure would gradually develop with time, and vegetation would mature and increasingly provide erosion protection. Hay Creek and surrounding drainages would be reclaimed to exhibit premining channel characteristics, and would be replaced in approximately the same locations. The basic hydrologic functions of the valley bottom would be restored to approximate premining characteristics.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on surface water in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area

boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. Water flow and direction in that area would be further altered by the removal and reconstruction of any drainage channels prior to mining, and redirected flow through the use of erosion- and sediment-control structures to manage surface water runoff from disturbed areas. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, impacts on surface water would be the same as those described for the Proposed Action but would extend to an area of up to 1,883 acres. Erosion and sediment discharge would likely increase in disturbed areas because of vegetation removal. Water flow and direction would be altered by the removal and reconstruction of drainage channels prior to mining and from redirected flow through the use of erosion- and sediment-control structures to manage surface water runoff from disturbed areas. Additionally, Hay Creek's main channel, extending from the NW corner of section 18 to the point where it enters the existing mine permit along the eastern section line of section 18, could be removed. Channels draining into the Hay Creek valley bottom could also be removed to recover coal in the western half of section 18 and section 19. As described in chapter 2, Kiewit does not anticipate relocating any county roads or causing new disturbance in the operationally limited lands between the two roads. Consequently, Kiewit does not anticipate the construction of any further diversions on Hay Creek west of the current permit boundary.

3.5.2.3 Regulatory Compliance, Mitigation, and Monitoring

If one of the action alternatives is implemented, Hay Creek and major channels will be restored after completion of mining operations, in accordance with SMCRA and Article 4 of the Wyoming Environmental Quality Act.

According to WDEQ/LQD Rules and Regulations (Chapter 4 Section 2(e)), other permit requirements include constructing sediment-control structures to manage and treat surface water discharges from disturbed areas and restoring reservoirs and playas disturbed during mining. Reservoirs in sections 17, 18, and 19 would be reconstructed and replaced in the approximate premining locations. Surface water quantity and quality in the restored Hay Creek channel would be monitored periodically per WDEQ/LQD requirements.

3.5.3 Water Rights

3.5.3.1 Affected Environment

The State Engineer's Office administers water rights in Wyoming, which are granted for both groundwater and surface water. Their records indicate that, as of May 2008, 2,380 permits for groundwater rights are within 3 miles of the general analysis area, 1,166 of which are for

non-coal applicants. Groundwater rights for non-coal applicants are listed in appendix G. The breakdown of groundwater rights is as follows:

- 324 stock, CBNG
- 152 CBNG
- 156 miscellaneous
- 101 monitoring
- 96 stock, miscellaneous, CBNG
- 71 miscellaneous, stock
- 73 stock
- 64 temporary filings
- 60 domestic, stock
- 38 domestic
- 19 CBNG, reservoir supply, miscellaneous
- 8 stock, miscellaneous
- 2 industrial
- 1 domestic, miscellaneous
- 1 irrigation

State Engineer's Office records indicate that, as of May 2008, 368 permits for surface water rights are within 3 miles of the general analysis area, 308 of which are for non-coal applicants. Surface water rights for non-coal applicants are listed in appendix G. The breakdown of surface water rights is as follows:

Adjudicated (129 total):

- 71 irrigation
- 26 miscellaneous
- 20 stock
- 9 irrigation, domestic
- 3 irrigation, reservoir supply

Un-adjudicated (179 total):

- 106 stock
- 32 irrigation
- 15 irrigation, reservoir supply

- 13 oil refining/production, temporary use, industrial, drilling
- 6 irrigation, domestic
- 5 industrial
- 2 stock, domestic

3.5.3.2 Environmental Consequences

Proposed Action

Under the Proposed Action, groundwater rights associated with existing water supply wells would experience moderate, long-term adverse impacts from the removal of aquifers in the proposed tract as a result of mining. Additionally, mine dewatering would affect existing wells near the proposed tract in the Wasatch or Fort Union formations above the Canyon coal seam; wells below the Canyon coal seam would not be affected.

Additional impacts on groundwater rights from CBNG development would continue. Impacts on water supply wells completed in the same coals where CBNG development is occurring may be affected as well as other wells that have hydraulic connections to these coals. The extent of impacts on these wells by CBNG development depends on how close they are to the CBNG extraction wells, the length of time groundwater withdrawals occur, and the hydraulic connection to aquifers from which CBNG groundwater withdrawals are occurring.

Under the Proposed Action, one surface water right, associated with the small tributary to Hay Creek that would be removed during mining, would be affected. Mining activities would affect surface water rights down-slope of the general analysis area as a result of significantly altered hydraulic characteristics of Hay Creek valley and its associated draws. Potential impacts include a reduction of surface water flow and a change in surface water quality from mining-related sediment discharges. Surface water rights up-slope of the general analysis area would not be affected.

Alternative 1 (No Action)

Under No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on water rights in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of impacts on downstream surface water rights resulting from the removal of Hay Creek from the N2 of section 17, as well as surrounding ephemeral draws, and impacts related to CBNG development from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, impacts would be the same as those described for the Proposed Action, but could occur over a larger area. Additional groundwater rights could be removed, and dewatering impacts on groundwater rights could extend farther to the west. One additional surface water right in the western half of section 18 could be removed; an additional reach of Hay Creek in the northwestern corner of section 18 could be removed; and channels that lead to the Hay Creek valley bottom could be removed to recover coal in the western half of sections 18 and 19. The latter two impacts are not expected because Kiewit does not anticipate relocating any county roads or causing any new disturbance on the operationally limited lands between the roads.

3.5.3.3 Regulatory Compliance, Mitigation, and Monitoring

SMCRA and Wyoming state statutes (Title 41—Water) govern the protection of groundwater and surface water rights. Mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality.

If one of the action alternatives is implemented, Kiewit will update the list of private water supply wells that could be affected by mining and predict impacts on those wells as part of the WDEQ/LQD permitting process. Kiewit will commit to replacing those water supplies affected by mining with water of equivalent quality and quantity. Kiewit will reconstruct Hay Creek, surrounding channels, and reservoirs to restore surface water rights affected by mining. The permit reclamation plan must specify reconstruction methods to restore surface water features similar to those characterized prior to mining. Periodic monitoring of surface water flows and quality will be required ensure that flows and water quality are similar to premining conditions.

3.5.4 Residual Impacts

The action alternatives would have significant impacts on groundwater quantity as a result of removing aquifers and extracting groundwater. Although groundwater quantity would begin to recover once the backfill is replaced and the aquifer recharge begins, full recovery of groundwater levels in and adjacent to the general analysis area could extend well beyond the life of mine. The action alternatives would have permanent impacts on groundwater elevations (i.e., water table depths) related to perching (underground benches that can trap water), geologic layering (affecting underground water flow), or heterogeneity (affecting permeability).

Groundwater quality is expected to return to premining conditions—adequate for livestock use—though it may exhibit slight but permanent variations related to the nature of the backfill.

Because of the ephemeral nature of Hay Creek in the general analysis area, the action alternatives would have no residual impacts on surface water. Successful reclamation would ensure that rainfall would be adequately conveyed through reclaimed channels and stored in reclaimed reservoirs.

3.6 Alluvial Valley Floors

This section discusses the affected environment as it relates to alluvial valley floors (AVFs) in the general analysis area and the adjacent Buckskin Mine permit area and identifies any impacts on AVFs that would result from the Proposed Action and alternatives.

Prior to leasing and mining, AVFs must be identified because, under the SMCRA, mining on AVFs is prohibited unless the affected AVF is undeveloped rangeland that is insignificant to farming or is of such small acreage that it would have a negligible impact on a farm's agricultural production. These restrictions also apply to AVFs that are downstream of mining but might be affected by streamflow or groundwater impacts. AVFs not significant to agriculture can be disturbed during mining but must be restored as part of the reclamation process.

3.6.1 Affected Environment

Hay Creek is ephemeral in nature (i.e., it responds only to rainfall or snowmelt events) as it enters the general analysis area in the SW4SW4 of section 7 and flows to the east. Down-valley of this location the creek bottom flattens a poorly defined channel throughout the remainder of the general analysis area. Section 3.5 describes various aspects of the Hay Creek drainage, including its physical characteristics, potential for flood irrigation, and apparent subirrigated areas, among other features. In alluvial valley floors, subirrigation refers to the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation (30 CFR 701.5).

WDEQ/LQD Rules and Regulations define AVFs as unconsolidated stream-laid deposits where water is available in sufficient quantities for agricultural activities (30 CFR 701.5). OSM and WDEQ/LQD have established guidelines to identify AVFs. These guidelines require detailed studies of geomorphology, soils, hydrology, vegetation, and land use, and are used to identify the following elements:

- presence of unconsolidated stream-laid deposits,
- potential for flood irrigation practices,
- evidence of past or present flood irrigation, and
- apparent subirrigated areas and the potential for natural flood irrigation.

Areas identified as AVFs following these studies are evaluated for their significance to farming by the WDEQ/LQD.

The WDEQ has not identified the agricultural productivity of the Hay Creek valley floor as significant to farming. Moreover, interviews with landowners and lessees who have agricultural operations in the Hay Creek valley floor consistently described failed or no attempts to develop artificial flood irrigation along Hay Creek (Buckskin Mining Company 2000).

3.6.1.1 Studies Conducted to Determine Presence of Alluvial Valley Floors

The primary AVF investigation in the general analysis area was completed in 2000. Investigations specific to section 16, east of that area, were completed by Triton Coal Company between 1980 and 1982, and the results from these investigations were incorporated into the 2000 investigation. These AVF studies were conducted as part of the WDEQ/LQD mine permitting process to recover coal under Buckskin Mine's existing leases.

These investigations initially concluded that the Hay Creek valley bottom (including the portion that passes through the general analysis area) is not an AVF, as defined by WDEQ/LQD. That agency challenged this conclusion and determined that a portion of the Hay Creek valley floor is an AVF. The Wyoming Environmental Quality Council overturned this determination and upheld the original conclusion that the valley floor is not an AVF. A copy of the Environmental Quality Council order is included in appendix H.

The findings of the investigations are described below.

Presence of Unconsolidated Stream-Laid Deposits

No stream-laid deposits are present in the general analysis area. Stream-laid deposits do occur in portions of the Hay Creek valley bottom and some associated upland draws beyond the general analysis area. Those areas consist of sand, gravel, and silt deposited by streamflow within Hay Creek and its tributaries. Prior to mining through the creek channel in the northern portion of section 17, mapped stream-laid deposits down-valley of the general analysis area occupied about 57 acres on the creek bed. These deposits typically varied from about 80 to 500 feet wide, and were about 20 feet thick. Stream-laid deposits terminate before entering the reservoir in the general analysis area in the SW4NW4 of section 17. Upstream of that reservoir in the general analysis area, the valley-bottom deposits consist of slope wash overlying bedrock. Slope wash occurs along the bottom slopes of hills and in channel bottoms, including the Hay Creek valley bottom in section 18, and consists of reworked sediment deposited by overland flow. These are not fluvial (stream-laid) deposits associated with Hay Creek.

Potential for Flood Irrigation

Runoff from the two-year, 24-hour storm event, generally considered agriculturally useful, yields about 11 acre-feet of water in the vicinity of the Buckskin Mine. This runoff volume is small relative to the cumulative storage capacity of reservoirs in the valley bottom and would not be sufficient to support any reliable flood irrigation practices.

Poor surface water and groundwater quality in Hay Creek and its alluvium, respectively, would make it generally unsuitable for domestic, agricultural, and livestock uses. The poor groundwater quality is attributed to the effect of reservoirs that locally concentrate salts and to natural groundwater quality characteristics of adjacent deposits that recharge the alluvium. Water quality is discussed in detail in section 3.5.

Groundwater quality in the Hay Creek alluvium is poor, and is generally unsuitable for domestic, agricultural, and livestock uses. Sulfate, which contributes to the overall TDS, is generally high

in the alluvium, roughly ten times the suitability criteria limits. The poor groundwater quality is attributed to the effect of reservoirs that locally concentrate salts and to natural groundwater quality characteristics of adjacent deposits that recharge the alluvium.

The agriculturally useful flood is of insufficient volume to support any reliable flood irrigation practices. Runoff from the 2-year, 24-hour storm event, which is generally considered to be of agricultural use, yields about 11 acre-feet of water. This runoff volume is small relative to the cumulative storage capacity of reservoirs in the valley bottom and will not produce a flood that is useful for irrigation.

Soils in the valley bottom also are of poor quality and are not suitable for irrigation purposes. Elevated electrical conductivity, boron, and selenium make the soils along Hay Creek unsuitable for irrigated row crops or improved pasture. The elevated electrical conductivity results in less water being available to plants because of osmotic potentials that exceed the capability of the plant to extract water from the soil. Boron toxicity may result in slowed growth and reduced production. Toxic concentrations of selenium may result in selenosis in livestock.

Evidence of Flood Irrigation and Subirrigated Areas

Plant species of agricultural interest have developed voluntarily in the native rangelands of the Hay Creek valley floor without any evidence that they were intentionally introduced for range improvement practices. Plant communities in the general analysis area that require flood irrigation are limited to the channel bottom along Hay Creek. Subirrigated vegetation occurs along and in the Hay Creek channel, adjacent to the channel in specific areas, and in isolated locations in upland areas. No evidence exists to indicate that these subirrigated plant species were specifically developed to exploit natural subirrigation.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action

Under the Proposed Action, no AVFs would be affected because none are present in the proposed tract. No primary drainages occur in the proposed tract. One isolated, ephemeral draw crosses the northwestern corner of the area, but it does not connect with Hay Creek or any other drainage, and, therefore, does not include AVFs.

As described in section 3.5, groundwater intercepted by dewatering activities would be routed through settling ponds to meet state and federal water quality criteria. Dewatering the alluvium in the proposed tract would not affect off-site alluvial groundwater downstream of the tract because no alluvium is present there and because the closed drainage in the area cannot contribute flow or alluvium to other systems. Dewatering could indirectly affect off-site alluvial groundwater up-valley of the proposed tract by creating a zone of influence (drainage area) that could extend beyond the tract boundary.

3.6.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. No AVFs have been identified within the portion of Hay Creek that overlaps the general analysis area and the existing Buckskin Mine permit area (i.e., the area already subject to disturbance). The majority of that segment of the creek channel has already been diverted as part of previously permitted mining activities, and Kiewit does not anticipate diverting any additional sections of that creek. As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area the future.

3.6.2.3 Alternative 2

Under Alternative 2, no AVFs would be affected because none are present in the general analysis area, including the Hay Creek channel and floodplain.

Mining could remove additional portions of the Hay Creek valley floor and associated features in the northern half of section 18 and the southwestern corner of the northwestern quarter of section 17. Kiewit does not anticipate any further diversions on Hay Creek, and has constructed a blocking dike at the western end of the current diversion to channel streamflow from the natural drainage into the existing structure. Indirect impacts (potential dewatering of alluvium) upstream of mine operations would be the same as those described for the Proposed Action, but could extend over a larger area.

The Buckskin Mine has constructed a diversion for the valley floor that has been mined out in section 17. As mining approaches the valley floor in section 18, dewatering activities would deplete alluvial groundwater in the valley. Mining would subsequently progress across the valley floor and remove the alluvium. Stream diversions could be constructed to ensure that instream flows are preserved while mining progresses across the valley floor, though no additional diversions are expected to be constructed at this time.

Groundwater intercepted by dewatering activities would be routed through settling ponds to meet state and federal water quality criteria. If additional diversions are constructed, discharges from these ponds would potentially increase the frequency and amount of flow in Hay Creek downstream of mining activities, thereby increasing surface water supplies outside the general analysis area to the east. Dewatering the alluvium in the final tract configuration would not affect off-site alluvial groundwater downstream of the tract because the alluvium in section 17 has already been removed. Dewatering could indirectly affect off-site alluvial groundwater up-valley of the tract by creating a zone of influence (drainage area) that could extend up-valley and northwest of the tract.

3.6.3 Regulatory Compliance, Mitigation, and Monitoring

WDEQ/LQD Rules and Regulations (Chapter 5) and SMCRA both relate to AVFs. If either of the action alternatives is implemented, the following mitigation and monitoring will be required.

Basic surface water functions in Hay Creek will be restored during reclamation to ensure that water can be conveyed from the upstream, undisturbed point on the creek channel to the downstream tie-in point east of the general analysis area. The portion of the channel that will pass through the reclaimed mine spoils will be constructed to simulate the characteristics of the premining native channel. Consideration will be given to erosional stability and to the reconstruction of ephemeral channels that would lead into the reclaimed valley floor. Surface water will be monitored to evaluate water quantity and quality through the reclaimed areas. Monitoring sites and frequency will be determined by WDEQ/LQD guidelines.

3.6.4 Residual Impacts

No AVFs have been identified in the general analysis area, and the majority of Hay Creek has already been diverted according to appropriate regulations to accommodate existing mining operations. Groundwater is expected to recharge and be reestablished in a similar manner to premining conditions, but may not exhibit the same hydrologic or chemical characteristics. The stream channel and the reclaimed valley floor would be reconstructed to mimic premining characteristics, but reconstruction would be an approximation. These impacts would be permanent but insignificant due to the absence of AVFs in the general analysis area.

3.7 Wetlands

This section discusses the affected environment as it relates to wetlands identified in the general analysis area through the National Wetland Inventory (NWI) mapping system (USFWS 2007) and identifies impacts on those wetlands that would result from the Proposed Action and alternatives. For the purposes of this analysis, wetland determinations in the general analysis area were based on the NWI maps and a 2007 reconnaissance-level field visit by trained ICF Jones & Stokes wetland biologists. The field visit was conducted to ground-truth the current status of previously mapped NWI wetlands, in keeping with current BLM Data Adequacy Standards (1987) for EIS analyses of wetlands.

3.7.1 Affected Environment

"Waters of the U.S." is a collective term for all areas subject to regulation by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act. Waters of the U.S. include special aquatic sites, large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of special aquatic site defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (33 CFR 328.3(a)(7)(b)).

Jurisdictional wetlands are defined as those wetlands that are within the extent of the Corps' regulatory review. These wetlands must contain three components: hydric soil, a dominance of

hydrophytic vegetation, and wetland hydrology.[2] The Corps, in conjunction with the EPA, has the authorization to determine whether a delinated wetland is jurisdictional or nonjurisdictional, as discussed in detail under section 3.7.3. Nonjurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated; nonjurisdictional other waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. Functional wetlands are areas that may contain only one or two of the three wetland criteria. The USFWS uses this third categorization in producing the NWI maps, which are based on aerial photo interpretation with limited or no field verification.

The NWI maps show several wetlands occurring in the general analysis area (USFWS 2007). Many of these areas correspond with wetlands and other waters of the U.S. that were identified during previous wetland delineations of the Buckskin Mine; however, some of the information shown on these maps is relatively old and does not reflect current conditions. Based on the NWI maps, approximately 64.44 acres of wetlands have been identified (map 3.7-1) in the general analysis area. Of these, 30.7 acres were determined to be potentially jurisdictional wetlands based on field observations (table 3.7-1); the remaining 33.74 acres were initially determined to be nonjurisdictional non-wetlands (e.g., borrow pits, old impoundments) or no longer present (table 3.7-2). The majority of the potential jurisdictional wetlands were associated with Hay Creek and other ephemeral tributaries in the general analysis area. Some wetlands previously mapped on the NWI may have been altered due to agricultural uses and permitted mine disturbance or CBNG-related water production in the general analysis area.

Table 3.7-1. NWI Wetlands in the General Analysis Area

Wetland Name	NWI Wetland Classifications[1]	Wetland Type	Field Determination[2]	Acres
NWI 1	PABFh	Freshwater pond	Wetland (impounded)	0.24
NWI 2	PEMAh	Freshwater emergent wetland	Wetland (CBNG pond)	0.26
NWI 5	PEMCh	Freshwater emergent wetland	Wetland (impounded)	0.10
NWI 6	PEMAh	Freshwater emergent wetland	Wetland (CBNG pond)	0.29
NWI 7	PEMA PEMC	Freshwater emergent wetland	Wetland (temporary ponding)	3.0
NWI 8	PUBFx PEMA PEMC	Freshwater emergent wetland and freshwater pond	Wetland (dry playa)	22.82
NWI 9	PUSAx	Other	Wetland (surface ponding)	0.10

[2] As a result of recent Supreme Court rulings (Solid Waste Agency of Northern Cook County vs. United States Army Corps of Engineers, January 9, 2001; and consolidated cases Rapanos vs. United States and Carabell vs. United States, known as the "Rapanos" decision, June 19, 2006) non-navigable, isolated intrastate wetlands (e.g., playas) and other waters of the U.S. are not considered jurisdictional.

Wetland Name	NWI Wetland Classifications[1]	Wetland Type	Field Determination[2]	Acres
NWI 11	PEMA	Freshwater emergent wetland	Wetland (farmed wetland)	2.24
NWI 12	PEMCh PABFh)	Freshwater emergent wetland and freshwater pond	Wetland (impounded)	0.58
NWI 14	PEMCh	Freshwater emergent wetland	Wetland (CBNG pond)	0.24
NWI 15	PEMAh	Freshwater emergent wetland	Wetland (impoundment)	0.15
NWI 17	PABFh	Freshwater pond	Wetland (dry impoundment)	0.68
Total Acres				**30.7**

NWI = National Wetland Inventory; P = palustrine; EM = emergent; AB = aquatic bed; US = unconsolidated shore; A = temporarily flooded; F = semi-permanently flooded; C = seasonally flooded; x = excavated; h = diked/impounded; CBNG = coal bed natural gas

1 Some of the wetlands studied had multiple wetland classifications associated with the wetland.

2 Based on 2007 reconnaissance-level field visit.Source: USFWS 2007; Cowardin 1979.

Table 3.7-2. NWI Wetlands Determined to Be Non-Wetlands in the General Analysis Area

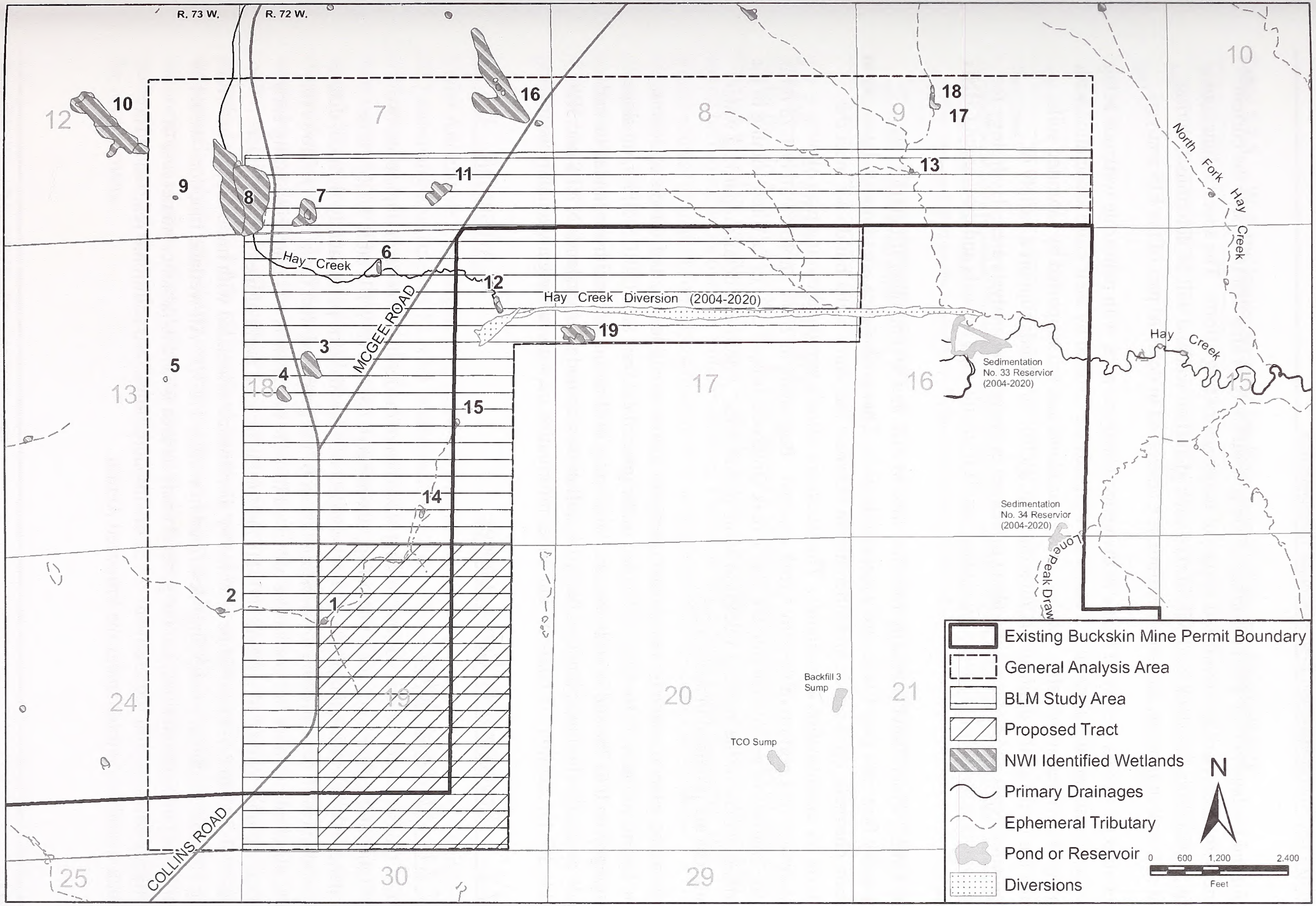
Wetland Name	NWI Wetland Classifications[1]	Wetland Type	Field Determination[2]	Acres
NWI 3	PEMA	Freshwater emergent wetland	Not a wetland (borrow pit)	2.58
NWI 4	PEMA	Freshwater emergent wetland	Not a wetland (borrow pit)	1.09
NWI 10	PABFh PEMA PEMAh	Freshwater emergent wetland and freshwater pond	Not a wetland	11.67
NWI 13	PEMC	Freshwater emergent wetland	Not a wetland (old impoundment)	0.10
NWI 16	PEMA PEMCx	Freshwater emergent wetland	Not a wetland (non irrigated hay field)	14.7
NWI 18	PEMCh	Freshwater emergent wetland	Not a wetland	0.16
NWI 19	PEMA PABFh	Freshwater emergent wetland and freshwater pond	Not a wetland (disturbed area)	3.44
Total Acres				**33.74**

NWI = National Wetland Inventory; P = palustrine; EM = emergent; AB = aquatic bed; A = temporarily flooded; F = semi-permanently flooded; C = seasonally flooded; x = excavated; h = diked/impounded

1 Some of the wetlands studied had multiple wetland classifications associated with the wetland.

2 Based on 2007 reconnaissance-level field visit or unrelated 2008 wetland delineation in the overlap between the general analysis area and existing permit area.

Source: USFWS 2007; Cowardin 1979.



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by BLM.

Map 3.7-1
Wetlands and Other Waters in the General Analysis Area

A formal wetland survey for the portion of the general analysis area that is outside the current mine permit area will be completed as part of future permitting efforts. The specific functions (e.g., agriculture, livestock, and wildlife) of each identified wetland will be determined during that delineation process, and are, therefore, not addressed in detail as part of the EIS analysis.

Wetlands occur in a variety of forms in the general analysis area, with palustrine wetlands being the most common and abundant. Palustrine wetlands are defined by their close association with emergent herbaceous marshes, swales, or wet meadows and are supported by saturated soils along the banks of the drainages (Cowardin et al. 1979). Wetlands support a variety of vegetation types and occur mainly along drainages in the general analysis area. Hydrology for these areas is provided primarily by surface runoff from adjacent uplands and discharged CBNG waters.

Hay Creek, which flows primarily from the west to east, and several other tributaries that generally flow into Hay Creek, are waters of the U.S. These tributaries are primarily intermittent stream channels, open water, and other stream channels that carry water but do not meet the criteria for classification as wetlands. The Buckskin Mine's approved mining plan allows disturbance of a portion of the Hay Creek channel. Beginning in 2006, approximately 1.75 miles of the channel were diverted into the Hay Creek Diversion (map 3.5-3) to facilitate mining in the northern extent of the existing Buckskin Mine permit area. Additional details regarding water resources are provided in section 3.5.

Soils in the general analysis area consist mainly of loams, sandy loams, and some clay loams. One hydric soil unit, Felix Clay, is located in the general analysis area (NRCS 2008), on slopes ranging from 0 to 2% and in soils that are developing in alluvium derived from sandstone and shale on gently sloping uplands. The hydric soil unit is located near wetlands NWI 8 and NWI 9 (table 3.7-1). Section 3.8 contains additional information on soils in the general analysis area.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action

Under the Proposed Action, surface mining would have moderate, short-term impacts on two NWI inventoried wetlands for a total of approximately0.48 acre (NWI 1, table 3.7-3). One wetland (NWI1) within the proposed tract consists of a small, semi-permanently flooded, diked impoundment in the extreme northwestern corner of the proposed tract (map 3.7-1). However, field observations over the years have indicated that the reservoir is wet primarily during early spring months. A second wetland (NWI14) in the buffer area north of the proposed tract (table 3.7-3, map 3.7-1) would be affected by disturbance associated with mine support activities (e.g., topsoil stripping, stockpiling) described in section 1.1.3.3. All wetland functions would be lost during mining activities, but the general analysis area would experience no net loss of wetlands due to permit requirements to restore impacted sites. No additional reaches of Hay Creek would be diverted under the Proposed Action.

Table 3.7-3. Wetland Impacts under the Proposed Action and Alternative 2

Wetland Name	Proposed Action (Acres)[1]	Alternative 2 Acres [2]
NWI 1	0.24	0.24
NWI 12		0.58[3]
NWI 14	0.24[4]	0.24[4]
NWI 15		0.15[3]
NWI 17		0.68[4]
Total Acres	**0.48**	**1.89**

1 Wetlands partially within the proposed tract were considered a full take, because a partial take of a wetland could affect the function of the entire wetland.

2 NWI 2, NWI 5, NWI 6, NWI 7, NWI8, NWI 9, and NWI 11 are located in the operationally limited lands where mining activity is not anticipated to occur; therefore, Alternative 2 would not affect these wetlands. The remaining NWI inventoried wetlands were confirmed as non-wetlands during the 2007 site visit (table 3.7-2).

3 Wetland is in overlap area between general analysis area and existing permit area, so impacts would also occur under No Action Alternative as a result of mine support activities described in section 1.1.3.3.

4 Wetland is in buffer area; impacts would be a result of mine support activities described in section 1.1.3.3.

3.7.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of impacts on approximately 0.73 acre of two NWI inventoried wetlands (table 3.7-3, map 3.7-1) as a result of activities necessary to support mining on existing leases, described in section 1.1.3.3. A third NWI inventoried site (NWI19) in the overlap area was confirmed as a non-wetland during the 2007 site visit. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.7.2.3 Alternative 2

Under Alternative 2, surface mining could have moderate, short- to long-term impacts on up to 30.7 noncontiguous acres of 12 NWI inventoried wetlands. However, the greatest acreage is west of one or both county roads in the area considered operationally limited by Kiewit; Kiewit does not anticipate relocating either road to access coal reserves. Therefore, it is most likely that up to 1.89 noncontiguous acres of five NWI inventoried wetlands would be affected under this alternative (table 3.7-3). Four of these five NWI wetlands are located in the BLM study area and would be directly affected by mining coal reserves. The remaining site is in the 0.25-mile-wide buffer, which would be affected by mine support activities (e.g., topsoil stripping, stockpiling) described in section 1.1.3.3. All wetland functions would be lost during mining activities, but the general analysis area would experience no net loss of wetlands due to permit requirements to restore impacted sites. Kiewit does not expect to divert any additional segments of Hay Creek under Alternative 2 due to the location of the drainage in the operationally limited area west of the county roads.

3.7.3 Regulatory Compliance, Mitigation, and Monitoring

If an action alternative is implemented, a wetland delineation will be completed according to approved procedures (Environmental Laboratory 1987) and submitted to the Corps for verification of the amounts and types of jurisdictional wetlands and other waters present. Kiewit will mitigate for all impacted jurisdictional wetlands in accordance with Section 404 of the Clean Water Act. Mitigation is required at a minimum one-to-one ratio for jurisdictional wetlands. The wetland replacement plan, which must be approved by the Corps, requires no net loss of wetland area and function.

Section 404 of the Clean Water Act does not cover nonjurisdictional wetlands; however, Executive Order 11990 requires that all federal agencies protect all wetlands. Mitigation for impacts on nonjurisdictional wetlands will be specified during the permitting process as required by the authorized state or federal agency (which may include the WDEQ/LQD, and the OSM). Because surface land in the general analysis area is privately owned, the private surface owner may also contribute to decisions regarding mitigation for impacts on nonjurisdictional wetlands. The WDEQ/LQD allows and sometimes requires mitigation of nonjurisdictional wetlands, depending on the quality of the wetland functions. That agency may also require replacement of wetlands or playas with hydrologic significance.

Wetland mitigation may begin prior to mining activities, depending on hydrologic resources available. Interim mitigation may be provided through the many sediment-control structures (ponds) created during mining, drainage diversion, removal of livestock from riparian areas, and repair of damaged wetlands.

3.7.4 Residual Impacts

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetlands, but all wetland replacement plans will be approved by the Corps, which has special required permitting procedures to assure that no net loss of wetlands will occur after reclamation.

3.8 Soils

This section describes the affected environment as it relates to soils in the general analysis area, and identifies potential impacts on soils that would result from the Proposed Action and alternatives.

3.8.1 Affected Environment

The affected environment described in this section is based on National Resources Conservation District soil surveys of Campbell County, Wyoming, which includes the proposed tract and general analysis area (National Resources Conservation Service 2004).

Soils vary in composition and depth depending on where and how they were formed. Major factors involved in the formation of soils include whether the material was transported, the source of the material, and how the material was weathered after transportation. Five soil formation processes causing different soil types were noted in the general analysis area: 1) soils developing predominantly in alluvium (stream-laid) or eolian (wind-blown) deposits derived from sandstone and shale on upland ridges; 2) soils developing predominantly in alluvium derived from sandstone and shale on gently sloping uplands; 3) soils developing predominantly in alluvium or colluviums (material that has been transported downslope by rock falls, slides, and slumps) derived from porcelanite on gently sloping uplands; 4) soils developing predominantly in residuum (residual material)weathered from sandstone and shale on gently sloping uplands; and 5) soils developing predominantly in alluvium over residuum weathered from sandstone and shale on gently sloping uplands.

Soil surveys were conducted in 2007 by BKS Environmental Associates, Inc., to an Order 1-2 resolution. The inventories included field sampling and observations at the appropriate number of individual sites to provide adequate sample sizes, and analysis of representative collected samples. Soils in the general analysis area were identified by series, which consist of soils that have similar horizons (distinct horizontal layers) in their profile (sequence of soil layers). Soil types and depths in the general analysis area are similar to soils currently being salvaged and used for reclamation at the Buckskin Mine and other nearby mines in northern Campbell County. Additional detailed information about the soil types sampled during 2007 is included in the soils data report, which can be viewed at the High Plains District office of the BLM in Casper, Wyoming. These site-specific soil surveys located hydric (saturated) soils and inclusions of hydric soils, which are components used in identifying wetlands. Wetlands are discussed in section 3.7 of this EIS. Areas with soils that are not suitable to support plant growth include sites with high salinity (salty content), high sodicity (amount of sodium present), or excessive clay or sand content.

3.8.2 Environmental Consequences

3.8.2.1 *Proposed Action*

Under the Proposed Action, mining of the proposed tract would have a direct, permanent effect on soil resources in up to 419 acres. Impacts associated with mining support activities described in section 1.1.3.3 would occur in a buffer area to the north of the proposed tract. Soils removed during mining would be replaced under reclamation. The replaced soils would have a more uniform soil chemistry and soil nutrient distribution. Average topsoil quality would be improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on reclaimed lands.

The baseline soils analysis of the proposed tract indicates that the amount of suitable soil available for redistribution on disturbed areas would have an average depth of 17 inches (1.4 feet). The replaced soil would support a stable and productive vegetation community

adequate in quality and quantity to support the planned postmining land uses (i.e., wildlife habitat and livestock grazing).

Reclamation would result in a temporary increase in the near-surface bulk density of soils in the proposed tract. The average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation, however, would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering would eventually form a new soil structure in the reclaimed soils. Infiltration rates would gradually return to premining levels. The reclaimed landscape would contain stable landforms and drainage systems that would support the postmining land uses. Reconstructed stream channels and floodplains would be designed and established to closely mimic preminng conditions and ensure proper drainage of water across the reclaimed spoils. Sediment-control measures would be implemented where runoff occurs to preserve reclaimed materials. Direct impacts on biological organisms in the soil on the proposed tract would include the short-term to long-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts in soil resources that are stockpiled before replacement.

3.8.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.8.2.3 Alternative 2

Under Alternative 2, impacts would have a direct, permanent effect on soil resources impacts in up to 1,883 acres. Impacts would also occur in the 0.25-mile-wide buffer around the final tract configuration associated with mining support activities described in section 1.1.3.3. The amount of suitable soil available for redistribution on disturbed areas would have an average depth of 17 inches. Soils removed during mining would be replaced with a more uniform soil mixture during reclamation. The replaced soil would support a stable, productive, and more uniform vegetation community adequate in quality and quantity to support the planned postmining land uses (i.e., wildlife habitat and livestock grazing). Infiltration rates would gradually return to premining levels. Reconstructed stream channels and floodplains would be designed and established to closely mimic premining conditions and ensure proper drainage of water across the reclaimed spoils. Sediment-control measures would be implemented where runoff occurs to preserve reclaimed materials. Direct impacts on biological organisms in the soil on the proposed tract would include the short-term to long-term reduction in soil organic matter, microbial

populations, seeds, bulbs, rhizomes, and live plant parts in soil resources that are stockpiled before replacement.

3.8.3 Regulatory Compliance, Mitigation, and Monitoring

If either of the action alternatives is implemented, Kiewit will mitigate for the impacts on soil resources in accordance with WDEQ/LQD reclamation standards and requirements.

Soils suitable to support plant growth will be salvaged for use in reclamation. Soil stockpiles will be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth will not be salvaged; soil or overburden materials containing potentially harmful chemical elements (e.g., selenium) will not be used in reclamation. A minimum of 4 feet of suitable overburden will be placed on the graded backfill surface below the replaced soil to meet state guidelines for vegetation root zones; those depths will be confirmed by sampling before topsoil is applied. Redistributed topsoil will be sampled to document redistribution depths and seeded to reduce wind erosion. Sediment-control structures will be constructed, as needed, to trap eroded soil. Vegetation growth will be monitored in reclaimed areas to confirm vegetation establishment and acceptability for bond release and determine if soil amendments are needed. Appropriate normal husbandry practices may be implemented to achieve specific reclamation goals.

3.8.4 Residual Impacts

The action alternatives would result in long-term alteration of soil characteristics. Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining.

3.9 Vegetation

This section addresses existing vegetation in the general analysis area and impacts on vegetation resulting from the Proposed Action and alternatives. Wetlands are addressed in section 3.7. Threatened, endangered, proposed, and candidate plant species, and BLM Sensitive Species are addressed in appendices I and J, respectively.

3.9.1 Affected Environment

The affected environment for the general analysis areas is based on the following:

- Vegetation communities in the portion of the general analysis area that overlaps the existing Buckskin Mine permit area (656 acres) were mapped and quantitatively sampled during baseline inventories for a permit amendment in 2000. All field sampling and mapping efforts were conducted in accordance with WDEQ/LQD mine permitting requirements.
- Vegetation communities in the remainder of the general analysis area (2,191 acres) were mapped and quantitatively sampled in 2007 and 2008 (LandTrak Resources, Inc. 2009); those efforts also complied with WDEQ/LQD permitting requirements. Additional detailed

information about these survey methods and results is included in the soils data report, which can be viewed at the High Plains District office of the BLM in Casper, Wyoming.

Vegetation in the general analysis area consists of species common to eastern Wyoming and is consistent with vegetation that occurs in the existing Buckskin Mine permit area. Eight distinct vegetation communities were identified and mapped in the general analysis area. Four additional categories were also mapped: disturbed areas, tree shelterbelts, rough breaks, and open water. Each of the latter three groups accounts for less than 1% of the total area. All vegetation communities and additional classifications are described below. Table 3.9-1 provides acreages and percent composition for each category.

3.9.1.1 Agricultural Cropland

Agricultural Cropland in the general analysis area consists of dryland, small grain production and alfalfa hay production. The small grain production appears to use a fallow rotation cropping system. The alfalfa hay production is mostly dryland. Approximately 25.5 % (727.1 acres) of the general analysis area is Agricultural Cropland.

3.9.1.2 Agricultural Pasture

The classification system used for Agricultural Pasture—low management, moderate management, and intensive management—evaluates management efforts based largely on the presence of sagebrush.

Low Management

Low management Agriculture Pasture, which contains significant stands of old-growth sagebrush, is not present in the general analysis area.

Moderate Management

Moderate management Agriculture Pasture accounts for approximately 3.0% (86.2 acres) of the general analysis area. This vegetation community is largely a mixture of cool-season, introduced pasture grasses such as crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*). A minor component of cool-season native species is present, as well.

Some management of shrub species has occurred in this vegetation community. Typically, this vegetation community is hayed when sufficient moisture has occurred to make harvesting economically viable. In dry years, this community is used as early-season pasture for livestock production. If it is not hayed for several years, the sagebrush will become reestablished in this vegetation community.

Intensive Management

Intensive management Agricultural Pasture accounts for approximately 2.0% (56.1 acres) of the general analysis area. This vegetation community is located mostly along the edges of Agricultural Cropland. It is typically mowed annually to allow access to the cropland. This vegetation community is comprised almost exclusively of cool-season, introduced pasture

grasses such as crested wheatgrass and smooth brome. Frequent mowing prevents shrubs from becoming reestablished.

3.9.1.3 Bunchgrass Prairie Grassland

Bunchgrass Prairie Grassland accounts for approximately 8.2% (232.8 acres) of the general analysis area. This community typically occurs on scoria sandstone or shale hills, knolls, and slopes that are moderately steep to steep. Soils are predominantly in the Ironbutte, Fairburn, Mittenbutte, Samday, Shingle, and Rock Outcrop map units that have shallow soils and usually a high coarse-fragment content.

Vegetation species associated with Bunchgrass Prairie Grassland include: little bluestem (*Schizachyrium scoparius*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread (*Hesperostipa comata*), and some blue grama (*Bouteloua gracilis*). Some big sagebrush (*Artemisia tridentata*) occurs in this community, typically in small, mosaic patterns as described in the Big Sagebrush Shrubland category, below.

3.9.1.4 Lowland Prairie Grassland

Lowland Prairie Grassland accounts for approximately 4.4% (124.9 acres) of the general analysis area. This community occurs primarily on gently sloping, often saline plains: on gently sloping benches usually adjoining Riparian Bottomlands: and in closed basins. Within this community, the amount of soil saturation, concentration of soil salts, and presence or absence of subirrigation varies with topographic position. Salt concentrations in lowland prairie soils influence plant-available water, thus affecting vegetation composition. Soil salt accumulations play a part in limiting moisture in the subirrigated category of the lowland prairie vegetation community.

Transitional zones between soil water conditions in this community may be abrupt, or gradual and subtle, depending on local topographic and stormwater runoff conditions. Some portions of the lowland prairie benefit from periodic subirrigation which usually results in more robust growth of community vegetation. When present, subirrigation water tends to occur 16 inches below the ground surface. Soils are predominantly Boruff, Haverdad, and Felix series.

Vegetation species associated with Lowland Prairie Grassland include: western wheatgrass (*Pascopyrum smithii*), saltgrass (*Distichlis spicata*), prairie cordgrass (*Spartina pectinata*), streambank/thickspike wheatgrass (*Elymus lanceolatus*), and big sagebrush.

3.9.1.5 Mixed-Grass Prairie Grassland

Mixed-grass Prairie Grassland accounts for approximately 16.2% (462.6 acres) of the general analysis area. This community occupies rolling hills and ridges with moderate to deep soil development. Soils are predominantly loams, sandy clay loams, fine sandy loams, and sandy loams. Occasionally, clay loams and loamy sands are found in this community. This community is most strongly correlated with deeper soils, including Bidman, Cambria, Kishona, Lawver, Teckla, and Wibaux loams, and Hiland sandy clay loam.

Vegetation species associated with Mixed-grass Prairie Grassland include: western wheatgrass, Indian ricegrass, needle-and-thread, blue grama, and big sagebrush. When big sagebrush occurs in this community, it is typically in small, mosaic patterns and accounts for less than 20% of the total vegetation cover composition.

3.9.1.6 Sandy Prairie Grassland

Sandy Prairie Grassland accounts for approximately 16.0% (455.9 acres) of the general analysis area. This community occurs on rolling hills and plains, with occasional wind blow-outs. It is most commonly associated with fine sandy loams and sandy loams (e.g., Taluce, Terro, Vonalee, and Vonalf soils), but also occurs on loams, sandy clay loams, loamy sands, and fine sands. The soil series is generally is found on deeper soils; however, moderately deep soils are not uncommon.

Vegetation species associated with Sandy Prairie Grassland include: Indian ricegrass, needle-and-thread, blue grama, prairie sand reed (*Calamovilfa longifolia*), and threadleaf sedge (*Carex filifolia*).

3.9.1.7 Riparian Bottomland

Riparian bottomland accounts for approximately 6.1% (174.3 acres) of the general analysis area. This community is associated primarily with Hay Creek and is limited in distribution due to the drainage's narrow width throughout most of its length. In a few atypical instances, isolated Riparian Bottomland communities grow on hillsides in saturated soils associated with groundwater seeps.

Species composition in riparian bottomland varies, and is primarily correlated with site-specific hydrologic conditions. This community can be subdivided into two main sub-communities: Riparian Bottomland Meadow and Riparian Bottomland Marsh. Riparian Bottomland Meadow is the predominate sub-community found throughout Hay Creek. The most prevalent vegetation type is cordgrass, with minor inclusions of spikerush and bullrush. Riparian Bottomland Marsh and emergent vegetation zones exist around the perimeters of stockponds. The dominant vegetation types in this sub-community are bullrushes, spikerushes, and sedges. Rushes typically have a higher relative cover value than cordgrass in these areas. Production values for Riparian Bottomland sites can vary independently of cover values.

These bottomland communities typically occur on soils that are characteristically deep and poorly drained, including Boruff series and mollic fluvaquents.

3.9.1.8 Big Sagebrush Shrubland

Big Sagebrush Shrubland accounts for approximately 10.6% (302 acres) of the general analysis area. For purposes of this study, this community is defined as areas in which shrub and sub-shrub species comprise more than 20% of the total vegetation cover. Big Sagebrush Shrubland is found on a variety of topography, including gentle slopes, rolling hills and steep, dissected breaks. This community occurs commonly on shallow clay loams (such as the Theedle

and Shingle series) and deep loams (such as the Forkwood and Cushman series), and occasionally on sandy loams. This shrub community occurs in a mosaic pattern across the landscape. Individual shrub patches range from 0.3 acre to 27.0 acres, with 4.9 acres as the average area. The patches are loosely connected by narrow corridors of other vegetation communities (usually Mixed-grass Prairie or Lowland Prairie Grassland) with only a few shrubs present.

3.9.1.9 Disturbed Areas

In addition to surface mining, several other forms of disturbance are present in the general analysis area. Those combined features comprise approximately 7.2% (208.4 acres) of the area and include county roads, historic two-track roads, CBNG roads and infrastructure, residential sites, and other disturbance not related to mining.

3.9.1.10 Tree Shelter Belt

Most of the trees in the general analysis area are associated with residential disturbance. Due to their extremely limited presence, residential trees were included in the tree shelterbelt category. One stand of plains cottonwood (*Populus deltoids*) is present in the southeastern quarter of Section 19, T52N R72W. That area falls within the overlap between the general analysis area and existing Buckskin Mine permit area. This cottonwood stand encompasses approximately 0.03% (0.8 acre) of the general analysis area.

3.9.1.11 Rough Breaks

Rough Breaks refers to areas within the general analysis area where rock outcrops and badlands clay soils are associated with steep topography and limited vegetation. This category comprises 0.4% (12.5 acres) of the general analysis area.

3.9.1.12 Open Water

Open Water refers to water standing in reservoirs and stockponds in the general analysis area. Water bodies comprise 0.1% (3.4 acres) of the general analysis area.

Table 3.9-1. Vegetation Communities in the General Analysis Area

	General Analysis Area		BLM Study Area		Proposed Tract	
Vegetation Community	Acres	Composition (%)	Acres	Composition (%)	Acres	Composition (%)
Agricultural Cropland	727.1	25.5	532.9	28.3	39.3	9.4
Agricultural Pasture: Moderate Management	86.2	3.0	54.4	2.9	3.7	0.9
Agricultural Pasture: Intensive Management	56.1	2.0	56.1	3.0	12.0	2.8
Bunchgrass Prairie	232.8	8.2	160.8	8.5	0.0	0.0
Lowland Prairie	124.9	4.4	77.1	4.1	2.2	0.5
Mixed Grass Prairie	462.6	16.2	207.1	11.0	41.7	10.0

	General Analysis Area		BLM Study Area		Proposed Tract	
Vegetation Community	**Acres**	**Composition (%)**	**Acres**	**Composition (%)**	**Acres**	**Composition (%)**
Sandy Prairie	455.9	16.0	331.5	17.6	252.6	60.3
Riparian Bottomland	174.3	6.1	77.4	4.1	4.1	1.0
Big Sagebrush	302.0	10.6	202.8	10.8	45.8	10.9
Trees: Shelter Belt	0.8	0.03	0.8	0.04	0.9	0.2
Disturbed: Roads	46.4	1.6	37.5	2.0	9.5	2.3
Disturbed: CBNG	41.0	1.4	19.1	1.0	7.0	1.7
Disturbed: Residential	20.4	0.7	20.4	1.1	0.0	0.0
Disturbed: Other Non-Mining	11.9	0.4	9.0	0.5	0.0	0.0
Disturbed: Mining	88.7	3.1	88.7	4.7	0.0	0.0
Rough Breaks	12.5	0.4	5.0	0.3	0.0	0.0
Open Water	3.4	0.1	2.0	0.1	0.0	0.0
Total[1]	**2,847.0**	**100.0**	**1,883.0**	**100.0**	**419.0**	**100.0**

CBNG = coal bed natural gas

[1] Totals are rounded.

Source: LandTrak Resources, Inc. 2009.

3.9.2 Environmental Consequences

Impacts on wetlands and wildlife/livestock relative to vegetative disturbance are discussed in section 3.7 and section 3.10, respectively.

3.9.2.1 Proposed Action

Under the Proposed Action, native vegetation would be temporarily and incrementally removed from the entire proposed tract (419 acres). Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance in a buffer area to the north of the proposed tract. This alternative would have the greatest impact on the Sandy Prairie Grassland community, because it is most prevalent (252.6 acres, 60.3%) in the proposed tract (table 3.9-1). Six of the remaining seven vegetative communities would also be affected, though to a considerably lesser degree. Some previously disturbed areas and one shelterbelt would be affected in the proposed tract, but no rough breaks or open water bodies would be affected. Mining support activities (described in section 1.1.3.3) would cause additional temporary surface disturbance a buffer area north of the proposed tract.

One stand of plains cottonwood (*Populus deltoides*) is present in the southeastern quarter of the proposed tract, in section 19, T52N R72W. This shelter belt encompasses approximately 0.2% (0.8 acre) of the proposed tract, and lies within the overlap between that area and the existing Buckskin Mine permit area. Consequently, the tree stand is already subject to future disturbance associated with previously permitted mining activities. Disturbance in the Agricultural Cropland and Agricultural Pastureland (13.1% of the total acreage, combined) would likely disrupt one landowner's ranching and farming operation.

Impacts associated with the removal of vegetation from the proposed tract and surrounding buffer could include increased soil erosion and differences between premining and postmining vegetative communities. Because the proposed tract is dominated by upland grasslands, the transition from native to reclaimed grasslands would be less dramatic and species composition would be expected to be more similar to premining communities. Vegetation loss and subsequent reclamation would likely occur incrementally across the proposed tract, depending on the direction and rate of mining. Impacts on vegetation from topsoil stripping and other mine-related activities would be addressed in accordance with the WDEQ/LQD approved mining and reclamation plan.

3.9.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary and incremental impacts on vegetation from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Vegetation loss and subsequent reclamation would likely occur incrementally across the currently permitted disturbance area, depending on the direction and rate of mining. The cottonwood trees in the overlap area would eventually be disturbed under previously permitted mining activities. Impacts on vegetation from topsoil stripping and other mine-related activities would be addressed in accordance with the WDEQ/LQD approved mining and reclamation plan.

3.9.2.3 Alternative 2

Under Alternative 2, native vegetation would be temporarily and incrementally removed over an area of up to 1,883 acres. Mining support activities described in section 1.1.3.3 would cause temporary surface disturbance within a 0.25-mile-wide buffer around the final tract configuration. This alternative would have the greatest impact on Agricultural Cropland, because it is most prevalent (727.1 acres, 25.5%) in the general analysis area (table 3.9-1). Each of the remaining seven vegetation communities and all four of the additional habitat classifications in the general analysis area could also experience some level of disturbance. The extent of that disturbance would range from 0.1 to 16.2% on individual habitat types, with the majority of combined impacts on agricultural lands and upland grasslands (table 3.9-1).

As described in section 3.9.1.9, three groups of trees (primarily cottonwoods) occur in the general analysis area; the shelter belt within the existing permit area is already subject to disturbance from previously permitted activities. Disturbance in the Agricultural Cropland and Agricultural Pastureland (30.5% of the total acreage, combined) would likely disrupt one landowner's ranching and farming operation.

Impacts associated with the removal of vegetation from the 0.25-mile-wide buffer could include increased soil erosion and differences between premining and postmining vegetative communities. The latter impacts would be reduced due to the similarity between premining and postmining vegetation. Vegetation loss and subsequent reclamation would likely occur incrementally across the final tract configuration, depending on the direction and rate of mining. Impacts on vegetation from topsoil stripping and other mine-related activities would be addressed in accordance with the WDEQ/LQD approved mining and reclamation plan. As noted, section 3.10 discusses indirect impacts on wildlife and livestock related to changes in vegetation. Mining activities under this alternative would not have impacts on trees within residential disturbance areas, unless Kiewit acquires the surface rights for those homes; the company does not intend to pursue that option.

3.9.3 Regulatory Compliance, Mitigation, and Monitoring

If either action alternative is implemented, reclamation, including revegetation, will immediately follow as mining progresses through the area. Estimates of the time elapsed from topsoil stripping through reseeding of any given area range from two to five years. This would be longer for areas occupied by stockpiles, haul roads, some sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until all coal removal has ended and active operations have ended. No new life-of-mine facilities would be built in the proposed tract or the final tract configuration, because in either case the tract would be mined as an extension of the existing mine. By the time mining ceases, more than 75% of disturbed lands will be reseeded. The remaining 25% will be reseeded during the subsequent two to three years as the life-of-mine facilities area is reclaimed.

Reclamation will approximate premining vegetation, and reestablished vegetation will primarily consist of native species except were agricultural lands occur. Areas reclaimed for native species will be revegetated as specified in the approved mine plan using reclamation seed mixtures approved by the WDEQ/LQD. Those efforts will likely focus on a mixture of upland prairie grasslands with graminoid/forb-dominated areas to simulate the dominance of upland grasslands in the premining landscape.

Initially, reclaimed lands will be dominated by grassland vegetation, which may be less diverse than the native premining vegetation, but more diverse than agricultural areas. At least 20% of the native vegetation area will be reclaimed to native shrubs at a density of one per square meter or as required by current regulations. Shrubs will be selectively planted in riparian areas and trees will be replaced at a one-to-one ratio. Estimates for the time it will take to restore shrubs, including sagebrush, to premining density levels range from one or two decades to up to 100 years. Native vegetation from surrounding areas would enhance reclamation activities through natural seed dispersal. The reclamation plan for the final tract configuration will include steps to control invasive, nonnative plant species.

Revegetation growth and diversity will be monitored until the final reclamation bond is released (a minimum of 10 years). Erosion will be monitored to determine if corrective action is needed

during establishment of vegetation. Controlled grazing will be used during revegetation as a management tool and to determine the suitability of the reclaimed land for postmining land uses. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond, a permanent, diverse, and productive vegetative cover would be established throughout the disturbance area. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity.

Reclamation of agricultural pastures and croplands may occur, but is highly dependent on the postmine topography and landowner agreements. It is most likely that agricultural lands will be reclaimed to pastures suitable for either haying or livestock rather than croplands. Such areas will be reclaimed using a seed-mix of native grass and legume species. Agricultural croplands will be reseeded to either annual cereal grain, such as winter wheat, or to hayland with a legume such as alfalfa. Again, reclamation of cropland is dependent on postmine topography and soil suitability for crop production. Following reclamation bond release, management of the privately owned surface areas would revert to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

Revegetation success and patterns in reclaimed areas would be at least partially affected by the influence of postmining topography on surface water drainage patterns. For example, the maximum postmining overland slope would be 20%, in accordance with WDEQ/LQD policy. However, the average reclaimed overland slope would not be known until the technical review of the permit revision application has been completed by the WDEQ/LQD. Although no significant changes in the average overland slope are predicted once reclamation is complete, the location and orientation of individual slopes could influence the direction and amount of runoff from rain and snow events, which could then result in different rates of vegetative reestablishment throughout reclamation.

The climatic record of the western U.S. suggests that droughts could occur periodically during the life of the mine. Such droughts could severely hamper revegetation efforts, because lack of sufficient moisture would reduce germination and could damage newly established plants. Severe thunderstorms could also adversely affect newly seeded areas. Same-aged vegetation would be more susceptible to disease resulting from increased vulnerability during periods of water stress (too little or too much) than plants of various ages. Once a stable vegetative cover is established, the impact of these events would be similar to impacts on native vegetation.

Restoration of wetlands is discussed in section 3.7; monitoring of livestock grazing standards is discussed in section 3.10.

3.9.4 Residual Impacts

Reclaimed vegetative communities may never completely restore the preming native plant community. Immediately following reclamation, revegetated areas would be characterized primarily by a mixture of upland prairie grasslands with graminoid/forb-dominated areas, which does resemble the current dominant community. An overall reduction in species diversity,

especially for the shrub component, could occur. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat and livestock grazing) should be achieved even with the changes in vegetation composition and diversity. No net loss of jurisdictional wetlands would occur due to restoration requirements of the Corps (section 3.7). Any wetlands serving as stockponds or other agricultural uses would be restored in accordance with the requirements of the surface landowner.

3.10 Wildlife

This section describes the affected environment as it relates to wildlife in the general analysis area and impacts on various species of wildlife and wildlife habitat that would result from the Proposed Action and alternatives.

3.10.1 General Setting

Section 3.1, section 3.2, and section 3.9 provide detailed descriptions of the general setting, topography, and vegetative composition, respectively, of the general analysis area. The most pertinent information for wildlife is summarized here for reference.

The terrain in the general analysis area consists primarily of gently sloping uplands and relatively level agricultural fields, with more rugged terrain in the northeastern portion of the area. Elevations in the general analysis area range from approximately 4,080 to 4,380 feet above mean sea level.

Predominant wildlife habitat types classified in the general analysis area broadly correspond with the major plant communities defined during the vegetation baseline study. The proposed tract is dominated (approximately 71%) by various upland grassland habitats (table 3.9-1). Habitats in the general analysis area are comprised primarily (71%) of upland grasslands (approximately 40%) and agricultural lands (croplands and pastures, 31%). A map showing the distribution of vegetative communities throughout the general analysis area is included in the wildlife data report, which can be viewed at the BLM High Plains District Office in Casper, Wyoming.

For this EIS, Big Sagebrush Shrublands are defined as vegetation communities where shrub and sub-shrub species comprise more than 20% of the total vegetation cover. This habitat type makes up less than 11% of both the proposed tract (approximately 46 noncontiguous shrub acres) and surrounding general analysis area (approximately 302 noncontiguous shrub acres). The shrub community is dominated by big sagebrush and occurs in a broken mosaic pattern across the landscape. Individual shrub patches range from 0.3 acre to 27.0 acres, with 4.9 acres as the average area. The patches are loosely connected by narrow corridors of other vegetation communities (usually Mixed-grass Prairie or Lowland Prairie), with few shrubs present. Other habitats present to a limited extent in the general analysis area include Riparian Bottomlands, Rough Breaks, Open Water, Tree Shelter belts, as well as previously disturbed areas (roads, pipelines, oil and gas storage tank complexes, and well pads).

No major drainages pass through the proposed tract itself, though a closed, unnamed drainage system crosses its northwestern corner (map 3.5-3). Hay Creek flows from west to east through the northern half of the general analysis area, with a considerable portion passing through the existing Buckskin Mine permit area. Several primary and secondary tributaries are also in that area. Under natural conditions, Hay Creek and all tributaries in the area are considered ephemeral (i.e., respond only to rainfall or snowmelt events). The determination of stream classification was made using the flume monitoring data collected by the Buckskin Mine and reported in the existing permit document. Additional information regarding groundwater and surface water in the general analysis area is presented in section 3.5.

CBNG discharge water has increased the frequency and duration of streamflow events in some portions of the general analysis area. The USFWS NWI maps (2007) show one small wetland (a 0.24-acre, semi-permanently flooded, diked impoundment) in the extreme northwestern corner of the proposed tract (map 3.7-1); however, field observations over the years have indicated that it is wet primarily during early spring months. One playa and one small instream impoundment are in the northwestern portion of the surrounding general analysis area. Those features are also seasonal, with water typically present in spring but dry by mid- to late summer. The playa is the only water body in the general analysis area that provides habitat for waterfowl, shorebirds, and other aquatic species. Due to its limited availability, it serves primarily as a staging area during spring migrations. Additional information regarding these water features is provided in section 3.5 and section 3.7. Due to the lack of permanent water sources, the general analysis area does not support any fisheries; fish species are, therefore, not discussed in this EIS.

As described in section 1.1.3, a variety of ongoing mining and reclamation support activities occur in the overlap between the general analysis area and existing permit area. Mine operations and facilities throughout the rest of the existing permit area include storage silos, coal crushing and preparation plants, and a railroad spur and loading facility, among others. These activities often involve variety of heavy equipment and occur 24 hours per day, every day of the year. Blasting occurs during daylight hours on a nearly daily basis. Disturbance and reclamation activities occur incrementally through the area. Because the mine operates at night, artificial lighting is present in active pit areas and on haul roads to ensure the safety of mine employees.

3.10.2 Survey Requirements and History

Long-term information on species occurrence and habitat use in the general analysis area was based primarily on results from annual wildlife monitoring surveys conducted for the existing Buckskin Mine over the past 25 years (1984 through 2008). The extent of these surveys was based on guidance from Appendix B of the WDEQ/LQD Coal Rules and Regulations, and included multiple seasons, depending on the species and requirements in place at the time. Appendix B specifies that annual wildlife monitoring surveys for larger, wide-ranging species at existing surface coal mines include the permit area and the area within a 0.5- to 2-mile radius, depending on the species. Surveys for smaller, less mobile species (e.g., small mammals and rabbits) or species with small breeding territories (e.g., breeding birds) are limited to the permit area only. Guideline 5 of those rules and regulations recommends that the survey area for

wildlife baseline inventories include the area that would be disturbed as a result of mining plus up to a 2-mile- radius, again depending on the species. Those baseline and annual monitoring survey areas were developed in collaboration with the WGFD and USFWS, the primary agencies responsible for regulating wildlife on non-federal surface in Wyoming.

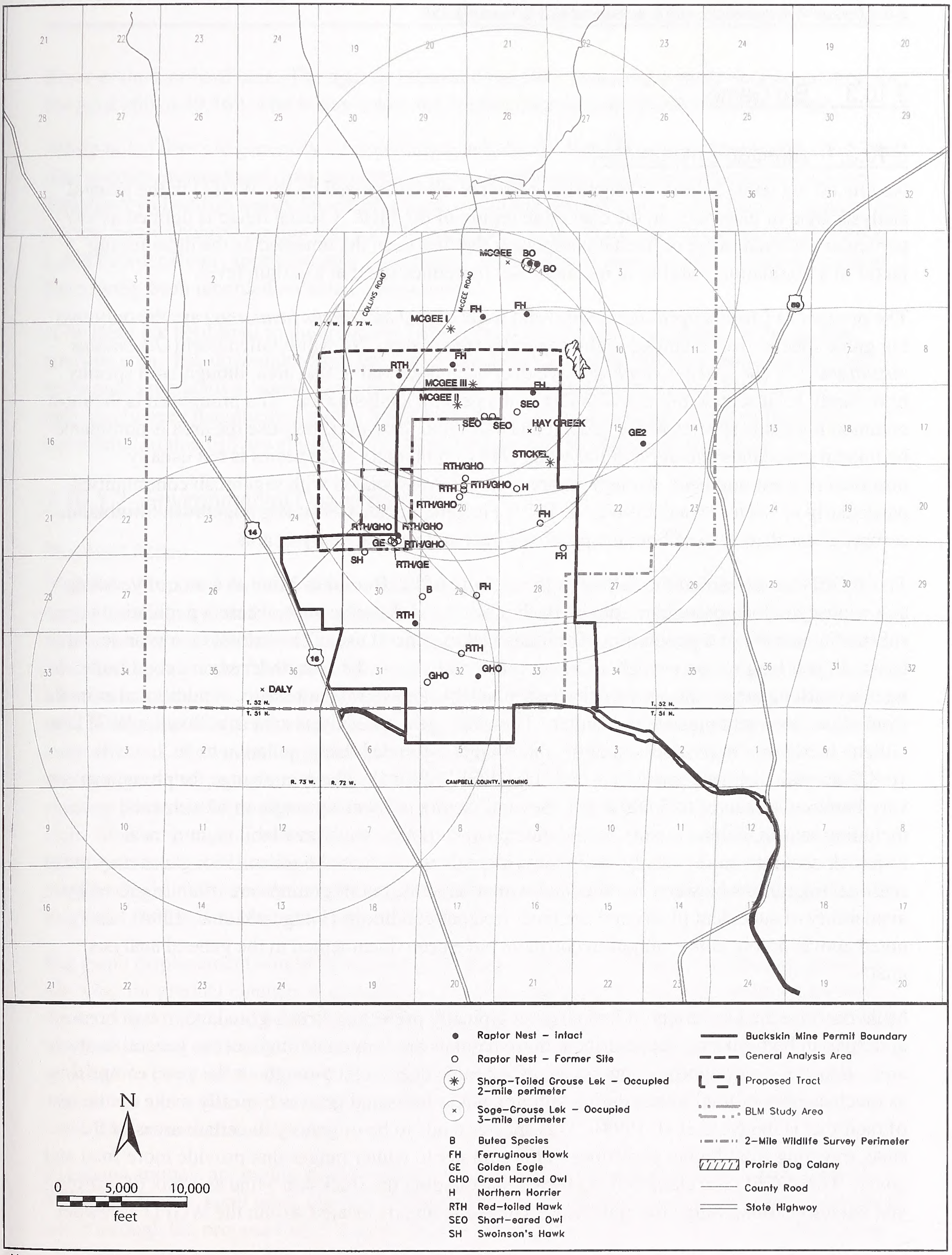
The BLM Data Adequacy Standards for the Powder River Coal Region (BLM 1987) describe the minimum data requirements needed to make coal leasing recommendations for wildlife populations and their habitats within the PRB Coal Production Region. Because most coal mines in the PRB have collected long-term annual monitoring data for a wide variety of vertebrate species as part of their WDEQ/LQD permit requirements, and because most surveys include lands outside the current permit area, the BLM typically accepts that information as meeting the minimum requirements of these standards. The long-term (25 years) database available for the Buckskin Mine permit area and surrounding lands meets those minimum requirements.

Guideline 5 and the BLM Data Adequacy Standards both call for up to a 2-mile radius for some species surveys. Therefore, the long-term data provided for this EIS analysis included the general analysis area and the area within a surrounding 2-mile radius (map 3.10-1). Because of its elevated level of concern in recent years, a 3-mile radius was used for sage-grouse leks (map 3.10-1). The 3-mile radius is the area in which two-thirds of the hens that were bred at those leks would be expected to nest.

Information for each major group of vertebrate species is provided in the following subsections. Supporting data and a vegetation distribution map for the general analysis area are included in the wildlife data report, which can be viewed at the BLM Wyoming High Plains District Office in Casper, Wyoming.

Due to their proximity to the existing Buckskin Mine permit area, the entire proposed tract and the southern third (33%) of the general analysis area have been included in annual wildlife surveys for the last 25 years (1984 through 2008). Approximately 95% of the general analysis area has been surveyed annually for the last seven years (2002 through 2008) in conjunction with a previous permit amendment at the mine. The entire general analysis area and expanded adjacent lands were included in targeted baseline surveys conducted for the LBA process from late 2007 through 2008.

Supplemental information on species occurrence and habitat use in the general analysis area was obtained from several sources, including: baseline inventories conducted at the Buckskin Mine from1977 through 1979 (original study), in 1988 (Spring Draw tract), and from early 1999 through early 2000 (original Hay Creek amendment); annual wildlife monitoring reports submitted to the WDEQ/LQD by the Buckskin Mine and overlapping Eagle Butte and Rawhide mines from 1984 through 2008; the *Final Eagle Butte Environmental Assessment* (BLM 1994); the *Final South Powder River Basin Coal EIS* (BLM 2003); the *Final EIS for the West Hay Creek Coal Lease Application* (BLM 2004); the *Final EIS for the Eagle Butte West Coal Lease Application* (BLM 2007c); and from BLM, WGFD, and USFWS records and contacts in 2007 and 2008.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.10-1

Raptor Nests and Grouse Leks in the Wildlife Survey Area

3.10.3 Big Game

3.10.3.1 Affected Environment

No crucial big game habitat or migration corridors are recognized by the WGFD in the general analysis area, or elsewhere in the coal mine region of the PRB. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level.

The pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are the only two big game species ever recorded in the general analysis area. No white-tailed deer (*Odocoileus virginianus*) or elk (*Cervus elaphus*) have ever been observed in that area, though both species have rarely been seen within 2 to 3 miles of the general analysis area. The pronghorn is the most common big game species in the general analysis area. However, because the area is dominated by upland grasslands and agricultural lands (71%, combined), this species is not usually observed in great numbers. Pronghorn are most often associated with sagebrush communities, particularly in winter (Sundstrom et al. 1973; Fitzgerald et al. 1994); Big Sagebrush Shrublands comprise less than 11% of both the proposed tract and general analysis area.

The WGFD has classified the habitat in the vicinity of the Buckskin Mine as a mix of yearlong and winter/yearlong pronghorn range. Both range types describe areas where a population or substantial portion of a population of animals makes general use of the habitat on a year-round basis. In yearlong range, pronghorn may occasionally leave the area under severe conditions. In winter/yearlong range, the area receives a predictable and significant influx of additional animals from other seasonal ranges in the winter. The entire general analysis area is within the WGFD's Gillette herd unit. In post-season 2007, the WGFD estimated that population to be 16,823 animals, with an objective of 11,000 (WGFD 2008a). The home range for pronghorn can vary between 400 acres to 5,600 acres. Several factors influence pronghorn movements, including season, habitat quality, population characteristics, water availability, and local livestock occurrence. Typically, daily movement does not exceed 6 miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). As noted above, no big game migration corridors have been documented in the general analysis area.

Mule deer use a wide variety of habitats, but typically prefer sagebrush-grassland, rough breaks, and riparian bottomland. As described, those habitats are limited throughout the general analysis area. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60% of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). This species tends to be migratory in certain areas of the state, traveling from higher elevations in the summer to winter ranges that provide more food and cover. The WGFD has classified the region surrounding the Buckskin Mine as a mix of yearlong and winter/yearlong range for mule deer. The entire area is located within the WGFD's Powder

River mule deer herd unit. The agency estimated the 2007 post-season mule deer population for the herd unit at 49,560, which was below the current objective of 52,000 (WGFD 2008a).

White-tailed deer are generally managed separately by the WGFD in the Central herd unit. This deer species prefers treed riparian habitats; no such habitats occur in the general analysis area. The agency classifies nearly the entire area as out of the normal white-tailed deer use range. The nearest known habitat for this species is located in the cottonwood corridor along the Dry Fork Little Powder River, approximately 2 miles east of the general analysis area. White-tailed deer have rarely been recorded outside of that corridor.

A resident elk herd lives in the Rochelle Hills located several miles southeast of the general analysis area. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands at some mines in the central and southern parts of the PRB but they have only rarely been documented within a few miles of the Buckskin Mine. None of the areas considered in this EIS are classified by the WGFD as within normal elk use range.

3.10.3.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have short-term, minor to moderate impacts on big game species; however, ongoing impacts, described above under "Affected Environment" would continue for two years beyond the current life-of-mine estimate. Some big game animals would be displaced from portions of the proposed tract to adjacent habitats during mining. Because they are more prevalent, pronghorn would be most affected. However, long-term (since 1984) monitoring at the Buckskin Mine has demonstrated that pronghorn are more common in sagebrush shrubland habitats south of the existing Buckskin Mine permit area than in the grasslands that dominate the general analysis area. Similarly, mule deer would experience few impacts, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas that would remain undisturbed by mining. No white-tailed deer or elk are present in the general in the general analysis area, so the Proposed Action would have no impact on them.

Big game displacement would be temporary and incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game living in the areas adjacent to the proposed tract could be adversely affected by increased competition from displaced animals. Noise, dust, and associated human presence would cause some foraging areas adjacent to mining activities to be avoided. However, pronghorn and mule deer have continued to occupy areas adjacent to and within active mining operations, suggesting that some animals do become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. The construction of additional fences, spoil piles, and pits related to mining would likely restrict big game movement on or through the proposed tract to some degree. Pronghorn may not be able to negotiate these

barriers during severe winter storms. However, WDEQ guidelines require fencing that is designed to permit passage of pronghorn and other big game species to the extent possible.

Changes in big game carrying capacity are not likely to be significant given the relatively low level of big game use in the area and the current dominance of upland grassland and agricultural habitats in potential impact areas. Mule deer have regularly been documented in reclaimed grasslands at the adjacent Buckskin Mine and elsewhere in the PRB. Eventual restoration of sagebrush and other shrub species would facilitate pronghorn use of reclaimed mine lands over time.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on big game and their habitat in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would consist of the short-term, minor to moderate impacts described for the Proposed Action as a result of activities necessary to support mining on existing leases, as described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration would have short-term, minor to moderate impacts on big game. Impacts would be the same as or similar to those described under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate. Because the general analysis area is dominated (71% combined) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats for big game, respectively, compared to those in the premining landscape.

Long-term monitoring conducted at the Buckskin Mine has demonstrated that pronghorn are not common in the grasslands and agricultural lands that dominate the general analysis area. Mule deer are even less abundant in this area; both species use suitable habitat in adjacent areas that would not be affected by either action alternative. No white-tailed deer or elk would be impacted under Alternative 2.

3.10.4 Other Mammals

3.10.4.1 Affected Environment

A variety of small and medium-sized mammal species may occur in the general analysis area. Some predators that could be present include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), and badger (*Taxidea taxus*). Prey species include various rodents (e.g., mice, rats, voles, gophers,

ground squirrels, and chipmunks), cottontails (*Sylvilagus* spp.), and jackrabbits (*Lepus* spp.). These prey species are cyclically common and widespread throughout the region and are important food sources for raptors and other predators.

Because water is extremely limited, species such as the muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*) are uncommon in both the proposed tract and general analysis area. Woodland species such as porcupines (*Erethizon dorsatum*) and bats (e.g., hoary [*Lasiurus cinereus*] and big brown [(*Eptesicus fuscus*]) also have little habitat in the general analysis area. Few of those species have been recorded in the area during the last 25 years of annual monitoring, and those that were observed were not seen with any regularity.

The black-tailed prairie dog (*Cynomys ludovicianus*) is a BLM sensitive species for the Buffalo Field Office due to its periodic occurrence in the federal listing process under the Endangered Species Act (ESA) of 1973, as amended. No prairie dog colonies occur in the proposed tract or general analysis area. The nearest colony is approximately 80 acres in size and is located in a narrow valley on the far side of a ridge that marks the northeastern extent of the general analysis area (map 3.10-1). This species was added as a candidate for federal listing under the ESA on February 4, 2000. The USFWS removed it from the candidate species list on August 12, 2004. On December 2, 2008, the USFWS announced a 90-day finding on a renewed petition seeking federal protection for the black-tailed prairie dog under the ESA; the finding indicated that listing as threatened or endangered may be warranted (*Federal Register*, Volume 73, No. 232, page 73211). The USFWS concurrently announced initiation of a 12-month status review to determine if listing the species is warranted. That agency continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them during this review process. Because neither action alternative would affect this species, no further discussion is provided for the black-tailed prairie dog in this section.

3.10.4.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have short-term, moderate impacts on small- and medium-sized mammals (e.g., lagomorphs, coyotes, and rodents) due to their ability to quickly recolonize reclaimed lands and the high reproductive potential of most of these species. Disturbance would be temporary and incremental. However, ongoing impacts described above, under "Affected Environment," would continue for two years beyond the current life-of-mine estimate. Because the proposed tract is dominated (71%) by upland grassland communities, the establishment of reclaimed grassland communities after mining has been completed would not result in a dramatic change in habitat types from the premining landscape.

Medium-sized mammals could be directly impacted by collisions with mine-related vehicles or traffic. Species inhabiting disturbed areas would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality, if those habitats are already

at their carrying capacity. These populations would rebound as vegetation is reestablished or small mammal prey species recolonize reclaimed areas. Direct losses of small mammals would be higher than for other wildlife because their mobility is more limited and many retreat into burrows when disturbed. Populations of prey animals such as mice, voles, and ground squirrels would decline during mining. However, these animals have a high reproductive potential and tend to reoccupy and adapt to reclaimed areas quickly. Results from research projects on small mammal use of reclamation conducted on mined lands in the Wyoming and Montana PRB have indicated that reclamation objectives to encourage recolonization by small mammal communities are being achieved (Clayton et al. 2006; Shelley 1992). No prairie dog colonies or reliable water sources are present in the proposed tract. The only trees in the proposed tract overlap the general analysis area and are, therefore, expected to be affected in the absence of the Proposed Action. Consequently, no prairie dogs, or species dependent upon water (e.g., muskrats) or woodlands (e.g., porcupines) would be affected under this alternative that would not be affected under the No Action Alternative.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on small- and medium-sized mammals and their habitats in the general analysis area would be short-term and moderate. Disturbance would occur incrementally and would be limited to the overlap between the general analysis area and the existing Buckskin Mine permit area, and would be associated with activities necessary to support mining on existing leases, as described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration would have short-term, moderate impacts on small- and medium-sized mammals. Impacts would be the same as or similar to those described under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate. Because the general analysis area is dominated by upland grassland communities and agricultural lands (71% combined), the establishment of reclaimed grasslands after mining has been completed would represent similar or somewhat improved habitats, respectively, compared to those in the premining landscape. No prairie dog colonies, or species dependent upon water (e.g., muskrats) or woodlands (e.g., porcupines) would be affected under this alternative that would not be affected under the No Action Alternative.

3.10.5 Raptors

3.10.5.1 Affected Environment

Map 3.10-1 shows the locations and physical status of raptor nests identified the general analysis area and baseline survey area for the Buckskin Mine since annual monitoring began at Buckskin and the adjacent mines; the survey areas for adjacent mines overlap that of Buckskin. Over time, new nests have been built, and natural forces have destroyed many nests; others have been relocated for mitigation or removed by mining activities. In some cases, new nests have been created to mitigate the loss of other sites impacted by mining operations. Eight intact raptor nests were present in the baseline survey area for raptors in 2008; only three were present in the general analysis area (map 3.10-1). Numerous intact and former nest sites are present elsewhere in the baseline survey area, beyond the general analysis area. Because these nest sites would not be affected by the Proposed Action or Alternative2, they are not discussed further in this section.

Raptor species that have historically been documented in the general analysis area include the golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), and short-eared owl (*Asio flammeus*). These species are year-round residents, seasonal visitors, or migrants, depending on the species. Burrowing owls (*Athene cunicularia*) could nest in old badger burrows, but they have not been recorded doing so in the area to date. Raptor species such as the northern goshawk (*Accipiter gentilis*), screech owl (*Megascops* spp.), and peregrine falcon (*Falco peregrinus*) are generally precluded due to the lack of appropriate habitats such as dense coniferous forests and riverine cliffs; those species have never been recorded in the general analysis area or at the adjacent Buckskin Mine.

Bald eagles and rough-legged hawks both occur in the vicinity of the Buckskin Mine during winter. The bald eagle is a migrant and common winter resident of the PRB, but is not common in general analysis area. Sightings in the general analysis area and at the adjacent Buckskin Mine have not been made with any regularity and have typically been limited to one or two individuals at a time. Both species occasionally perch in the small grove of trees in the southeastern corner of the proposed tract where it overlaps with the existing permit area and, therefore, are likely to be exposed to disturbance under existing conditions.

On July 9, 2007, the USFWS published a *Federal Register* notice (Volume 72, pages 37346–37372) announcing that the bald eagle would be removed from the list of threatened and endangered species under the ESA; delisting was effective August 8, 2007. However, the protections provided to the bald eagle under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act will remain in place. The bald eagle is recognized as a BLM sensitive species due to its former listed status and is further discussed in appendix J of this EIS.

The red-tailed hawk and great horned owl are the only two raptor species that nest with any regularity in the general analysis area, including in the proposed tract (map 3.10-1). The golden

eagle and short-eared owl have infrequently nested in the general analysis area over time. One pair of Swainson's hawks has periodically built a nest just outside the general analysis area but has never laid eggs. Although nest structures typically associated with ferruginous hawks have been found in the general analysis area, no active nests have been documented during 25 years of annual monitoring. As described previously, habitat is limited or absent for those species that nest exclusively in trees, on cliffs, or in prairie dog colonies. Several pairs of red-tailed hawks and great horned owls have adapted to nesting on mine highwalls and facilities such as coal crushers, silos, and other load-out structures at multiple coal mines in the PRB in recent years. The USFWS does not require mitigation for such nest sites at surface coal mines in northeast Wyoming due to the fact that disturbance activities were ongoing and continuous when raptors arrived to begin nesting.

3.10.5.2 Environmental Consequences

Table 3.10-1 presents the potential impacts on raptor nest sites (intact and former) under each alternative.

Table 3.10-1. Potential Impacts on Raptor Nest Sites[1] (Intact and Former) in the General Analysis Area (through 2008) Under the Proposed Action and Alternatives

Species	Alternative 1 (No Action)[2]	Proposed Action	Alternative 2[3]
INTACT NESTS			
Red-tailed hawk	0	0	1
Red-tailed hawk/great horned owl	1	1	1
Ferruginous hawk	0	0	1
Total Intact Nests	**1**	**1**	**3**
FORMER NEST SITES			
Red-tailed hawk/great horned owl	2	2	2
Red-tailed hawk/golden eagle	1	1	1
Golden eagle	1	1	1
Short-eared owl	2	0	2
Total Former Nest Sites	**6**	**4**	**6**

[1] Rows are not summed across.
[2] Nests within the overlap between the general analysis area and existing Buckskin Mine permit area only.
[3] Nest(s) within the general analysis area only (nest number based on maximum potential area of disturbance associated with leasing action).

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have no new impacts on known raptor nest sites. One intact nest and four former nest sites are present in the

proposed tract (map 3.10-1, table 3.10-1); however, all five nest sites are in the tree grove that overlaps the existing Buckskin Mine permit area and would eventually be disturbed by previously approved mining activities. Those five nest sites have historically been used by red-tailed hawks, great horned owls, and golden eagles, but only hawks and owls have used the tree grove since 1998. The eagle pair expanded its territory to the south that year and has not returned to the general analysis area.

Ongoing impacts on existing nests and nesting habitats from current facilities and mining techniques would be the same as those described above under "Affected Environment," but would continue for up to two years beyond the current life-of-mine estimate; these existing impacts would be short-term and moderate. Because the proposed tract is dominated (71%) by upland grassland communities, the establishment of reclaimed grassland communities after mining has been completed would not result in a dramatic change in habitat types from the premining landscape.

Long-term monitoring data have demonstrated that the most consistent raptor pairs in the vicinity of the Buckskin Mine regularly nest within 0.25 mile and in view of regular human disturbance; thus, they are acclimated to having some level of activity occur near their nests. For example, one pair of red-tailed hawks has nested within 400 feet of an occupied residence and 600 feet from the McGee Road each year from 2002 through 2008, fledging young in all but one year. Great horned owls at Buckskin and other PRB mines regularly nest on active mine facilities such as coal crushers and batch load-outs. Details regarding raptor nesting efforts and success near mine operations are available in the Buckskin Mine annual wildlife reports, as well as those for other regional coal mines, on file with the WDEQ/LQD in Sheridan, Wyoming.

Despite their apparent acceptance of regular human disturbance near active nests, mining activity could cause raptors to abandon nests near disturbance, particularly if operations unintentionally encroach on active nests during a given breeding season. Mining activities could also remove intact nests during the non-breeding season. Although these actions could have an impact on individual birds or pairs, mining associated with the Proposed Action would not have an impact on regional raptor populations, because the level of use by nesting raptors is low in the area. Additionally, the Buckskin Mine has a USFWS-approved raptor mitigation plan in place for the existing permit area to minimize negative impacts on nesting raptors and provide mitigation, as needed. The raptor mitigation plan would be revised during the permitting phase to accommodate the proposed tract. Continued use of those mitigation measures would further reduce risks to nesting raptors. The current plan and the USFWS approval letter are included in the existing Buckskin Mine permit document, on file with the WDEQ/LQD in Sheridan, Wyoming.

Under the Proposed Action, surface mining would reduce the availability of native foraging habitats for both nesting and non-nesting raptors. Because native habitats in the vicinity of the general analysis area are dominated by upland grasslands, ground-nesting raptors and those foraging in the area should be able to transition easily to reclaimed grassland parcels. Equipment yards associated with mining provide additional habitat for prey species such as cottontails and

rodents. Raptor pairs have voluntarily and repeatedly nested near such areas at Buckskin and other coal mines in the PRB. Results from annual monitoring of prey populations at these mines have demonstrated that raptor nesting efforts and productivity at surface coal mines in northeast Wyoming have been influenced primarily by natural factors such as prey abundance, untimely inclement weather, and availability of nesting substrates. Due to the limited presence of trees and lack of tall cliffs, raptor species that nest in those features are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other human-made structures (e.g., platform nests). During mining, new nesting habitat can be created in reclaimed areas through enhancement efforts like the installation of platform nests, relocation of snags, and tree plantings.

Bald eagle sightings in the vicinity of the general analysis area have averaged only 0.5 per winter over the last 25 years (1984 through 2008); no bald eagle nests have ever been documented at the Buckskin Mine. One or two individuals have infrequently been seen perched in the trees in the southeastern corner of the proposed tract during that period, but the tree stand has not officially been classified as a winter roost site. As described previously, those trees are within the existing Buckskin Mine permit area and are already subject to future disturbance and/or appropriate mitigation measures that might be necessary.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on raptor nest sites and habitat in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would be associated with activities necessary to support mining on existing leases, as described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

One intact raptor nest and six former nest sites are located in the overlap between the general analysis area and the permit area (map 3.10-1, table 3.10-1). As described under the Proposed Action, red-tailed hawks, great horned owls, and golden eagles have historically nested in the tree grove that also alls within the proposed tract, but only hawks and owls have nested there since 1998. Short-eared owls have nested elsewhere in the overlap area, but those sites have already been disturbed by previously permitted mine operations within the general analysis area.

Because native habitats in the vicinity of the general analysis area are dominated by upland grassland species, ground-nesting raptors and those foraging in the area should be able to transition easily to reclaimed parcels. Impacts on raptors using the trees in the overlap area for perching or nesting would be the same as described under the Proposed Action.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration would have new impacts on two intact raptor nests (table 3.10-1, map 3.10-1); the

remaining intact nest falls within the tree grove discussed under the Proposed Action and No Action Alternative. No additional former nest sites would be added under Alternative 2. Ongoing impacts on existing nests, nesting habitat, and foraging habitat from current facilities and mining techniques would be the same as those described for the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate; these impacts would be short-term and moderate. Because the general analysis area is dominated (71% combined) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats, respectively, compared to premining conditions. These reclaimed areas would provide alternate nesting and/or foraging habitats for local raptors.

Only two other stands of trees are present in the general analysis area besides the one in the overlap area, described for the Proposed Action; both are located adjacent to currently or recently occupied residences. Red-tailed hawks were first documented nesting near an occupied residence located between the McGee and Collins roads in 2002; the pair fledged two young that year. Hawks nested in that shelterbelt in each of the subsequent six years, despite increased activity at the residence in recent years; young fledged in five of those six years. No raptor nests have been documented in the shelterbelt near the recently vacated residence west of the junction of these roads. The lone intact ferruginous hawk nest in the general analysis area has never been active in the years since it was discovered in 1999. No active nests for this species have ever been recorded near the Buckskin Mine during the last 25 years of annual monitoring, although the presence of ground nests that are characteristic of ferruginous hawks suggests historic nesting activity. These ground nests can persist for many years without use as a result of the dry climate.

Three additional intact raptor nests are located beyond, but within 0.5-mile of the general analysis area (map 3.10-1); that is the distance recognized by the BLM as an adequate buffer between disturbance and nests of most raptor species. All three structures have been classified as ferruginous hawk nests due to their physical locations and composition, but none have been active since their respective discoveries. One of those three nests is in the overlap area and will be impacted regardless under all alternatives. The remaining two structures are approximately 0.5 mile north of the general analysis area. These nests are separated from the general analysis area by multiple ridges and, thus, are buffered from future visual and audio disturbance in that area.

As described in chapter 2, Kiewit does not anticipate relocating either county road. Should those areas be leased and scheduled for disturbance, the Buckskin Mine would be required to revise its monitoring and mitigation plan to provide adequate protection from mine-related disturbances for nesting or roosting raptors.

3.10.6 Upland Game Birds

3.10.6.1 Affected Environment

Upland Game Birds

Four upland game bird species are known to occur in suitable habitats in the general analysis area: the mourning dove (*Zenaida macroura*), gray partridge (*Perdix perdix*), sharp-tailed grouse (*Tympanuchus phasianellus*), and greater sage-grouse (*Centrocercus urophasianus*), hereafter referred to as sage-grouse. Although all four species have been documented in and around the general analysis area over time, sightings typically consisted of fewer than 10 birds at a given location.

The mourning dove is the most common upland game bird species in the vicinity of the Buckskin Mine. Doves are especially abundant during spring and fall migrations, with fewer observations during the nesting season. This species is also a relatively common breeding bird in Campbell County and may be found in a variety of habitat types (Cerovksi et al. 2004). Doves are often seen near sites with water sources and trees, though they are occasionally observed in sagebrush and greasewood stands. Mourning doves were recorded in the general analysis area, including in the proposed tract, during surveys conducted in both 2007 and 2008, and in previous years. Individuals observed in the proposed tract were most often associated with the small stand of trees in the southeastern corner that overlaps the existing Buckskin permit area.

The gray partridge (a.k.a. Hungarian partridge or Hun) is an introduced, non-migratory game bird that forms flocks (or coveys) outside the breeding season. Gray partridge have observed along the reclaimed channel of Rawhide Creek inside the existing Buckskin permit area; that area is approximately 1.5 miles southeast of the general analysis area. However, this species is not encountered with any regularity, with intervals of several years passing between sightings. No gray partridge were observed in the general analysis area during 2007 or 2008.

The greater sage-grouse is a species of concern throughout the West and, as such, is given greater consideration in this EIS. Although the sharp-tailed grouse does not have the same status as sage-grouse, it has been documented at the Buckskin Mine over the years. Surveys for both species are conducted using the same timing and protocols. Consequently, portions of the following discussion apply to both species. Individual discussions are provided by species, where appropriate.

Grouse Terminology and Survey Methods

The WGFD manages and regulates grouse populations in Wyoming, while the WDEQ/LQD regulates surface coal mines in the state. Survey protocols for grouse used at Buckskin and other coal mines in northeast Wyoming are based on Appendix B of the WDEQ/LQD Coal Rules and Regulations. The wildlife survey and reporting protocols in this document are based on input and guidance provided by the WGFD. Those protocols are used during all baseline and annual monitoring efforts conducted at surface coal mines in the Wyoming PRB. For consistency with those efforts, WGFD nomenclature for leks and their management status is used in this EIS.

A lek is defined as a traditional courtship display area attended by male grouse (WGFD 2006). For sage-grouse, leks are typically located in sagebrush dominated habitats. Sharp-tailed grouse leks can be found in both grassland and sagebrush habitats. The WGFD designates display sites as leks based on observations of two or more male grouse engaged in courtship displays made on two separate occasions during the appropriate time of day (WGFD 2006). Sub-dominant males may display on temporary strutting areas during population peaks, but those areas usually fail to become established leks. Therefore, the WGFD requires sites where small numbers (less than five) of males are observed strutting to be confirmed as active for two years before adding the site to the lek database. A group of leks in close enough proximity for males to move among them from one day to the next is considered a lek complex. A specific distance criterion to define a complex does not yet exist (WGFD 2006).

The WGFD has adopted definitions for lek status to provide consistency in nomenclature when collecting and reporting sage-grouse data (WGFD 2006). The definitions describe the annual status and a long-term management status of sage-grouse leks; those definitions can also be applied to sharp-tailed grouse leks. The status is assessed annually based on the following definitions:

- Active—any lek that has been attended by male grouse during the strutting season.
- Inactive—any lek where sufficient data suggests that there was no strutting activity throughout a strutting season.
- Unknown—leks for which status as active or inactive has not been documented during the course of a strutting season.

The WGFD management status is based on a lek's annual status, and includes three categories:

- Occupied—a lek that has been active during at least one strutting season within the prior 10 years. Occupied leks are protected through prescribed management actions during surface-disturbing activities.
- Unoccupied (formerly "historical lek")—This category is further divided into two sub-groups: "destroyed" and "abandoned." Unoccupied leks are not protected during surface-disturbing activities.
  - Destroyed—A formerly active lek site and surrounding habitat (including sagebrush) that have been destroyed and are no longer suitable for grouse breeding.
  - Abandoned—A lek in otherwise suitable habitat that has been "inactive" during the most recent 10 consecutive strutting seasons.
- Undetermined—Any lek that has not been documented as active in the last 10 years, and for which survey information is insufficient to designate it unoccupied. Undetermined leks are protected through prescribed management actions during surface-disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied.

The Buckskin Mine has conducted surveys of known grouse leks and searches for new leks as part of its wildlife baseline inventories and annual wildlife monitoring programs since the late

1970s and mid-1980s, respectively. Baseline inventories, which occurred prior to initial permitting and subsequent permit amendments, encompassed the mine's permit area and the area within a 2-mile-wide radius. Lek counts have been conducted in the Buckskin Mine permit area and the area within a 1-mile-wide radius as part of the annual monitoring program for the last 25 years (1984 through 2008). The annual monitoring area was expanded to accommodate each new amendment as it was approved. Due to the proximity of the proposed tract to the existing mine, the entire proposed tract and most of the general analysis area have been included in previous survey efforts since 1984.

Annual lek counts were voluntary until 1993, when the WDEQ/LQD issued the monitoring guidelines in Appendix B. Counts are conducted at seven- to ten-day intervals over a three- to four-week period from early April through early May each year per WGFD (2006) survey protocols. Surveys are conducted from the ground between 0.5 hour before sunrise and 1 hour after sunrise, and only during appropriate weather conditions (i.e., light wind and no precipitation). Each lek site is checked at least once in spring, with active leks counted at least three times. Repeated counts of males and females are made at each site until a consistent peak count is recorded.

Specific surveys for nesting and wintering grouse are not part of the Appendix B annual monitoring requirements for surface coal mines in the Wyoming PRB. However, seasonal ground surveys for other wildlife species have been conducted in potential grouse nesting habitats annually since 1984, including numerous walking surveys in sagebrush and other habitats targeting other ground-nesting species each spring. Surveys for winter grouse use have been conducted as part of the required baseline inventories for previous and proposed permit amendments over the years. Biologists conducted the surveys by driving and walking through sagebrush habitats watching for grouse and their sign (snow tracks, droppings, feathers) during winter months. Sage-grouse were also recorded during other wildlife surveys described in this section.

Targeted surveys for sage-grouse broods were conducted as part of the required annual monitoring program twice each July from 1995 through 1999. Based on the lack of brood sightings at coal mines throughout the region, the WGFD recommended in 1999 that surveys for grouse broods be dropped from annual monitoring requirements under Appendix B. The Buckskin Mine voluntarily continued brood surveys through summer 2001 before amending its WDEQ/LQD mining permit to remove that survey requirement. Due to the increasing concern about the sage-grouse throughout its range, the mine voluntarily conducted grouse brood surveys annually from 2004 through 2008. All surveys were conducted by walking along approximately 4 miles of native and reclaimed drainages (2 miles each) within the existing Buckskin Mine permit area and recording any grouse or grouse sign observed. Similar surveys were conducted in drainages within proposed expansion areas over the years as part of baseline inventory requirements. Coincidentally, some survey routes included drainages within the general analysis area. Biologists also watched for and recorded any sage-grouse and broods seen incidental to other wildlife surveys during all monitoring years.

Sage-Grouse Life History

The sage-grouse is considered a "landscape species," which means that large expanses of unfragmented land are required to provide all the habitat components necessary for their annual life cycle. This species is a sagebrush-obligate, and requires sagebrush habitat year-round for food, cover, and shelter, and for every phase of its life cycle. Sage-grouse often exhibit seasonal movements to use discrete sagebrush habitats, though the distance traveled varies widely among populations. These movements are often in response to devotion to seasonal-use areas (i.e., breeding, nesting/brood rearing, summering, and wintering), with adjustments related to severity of winter weather, topography, and vegetative cover.

Sage-grouse breeding occurs on leks during late March and April. Leks are generally established in open areas surrounded by Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), which is used for escape cover and protection from predators. Generally, lek sites are used year after year and are considered the center of year-round activity for resident sage-grouse populations. On average, approximately two-thirds of sage-grouse hens nest within 3 miles of the lek where they were bred. New spring plant growth, residual cover, and understory are important habitat components for nesting sage-grouse hens.

Areas near nests are used for several weeks by hens for brood rearing. The habitats used during the first few weeks after hatching must provide both good cover to conceal the chicks and essential nutritional requirements during this period of rapid development. Brood-rearing habitats that have a healthy and wide diversity of plant species, particularly grasses and forbs, tend to provide the variety and abundance of insects that are an essential protein supply for the young birds.

Summer habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated agricultural fields. As summer progresses and forbs mature and dry up, sage-grouse broods must move to more mesic or wet meadow-type habitats where succulent plants and insects are still available. This can be especially important in drier years and during extended periods of drought. As the fall season nears, sage-grouse form flocks as brood groups come together. As fall progresses, sage-grouse move toward their winter ranges.

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush to be accessible, especially in areas where snowfall is common. It is crucial that sagebrush be exposed at least 10 to 12 inches above snow level, as this provides food and cover for wintering sage-grouse. Population and habitat analyses suggest that wintering habitat can be as limiting as breeding habitats.

Regional and Statewide Sage-Grouse Population Trends

Overall, the sage-grouse population has been steadily declining in Wyoming and across the rest of the West. A study prepared by the Western Association of Fish and Wildlife Agencies estimated that sage-grouse populations in western North America declined at an overall rate of 2% per year from 1965 to 2003 (Connelly et al. 2004). The decline rate was greater from 1965 to 1985, with populations stabilizing and some increasing from 1986 to 2003. For Wyoming,

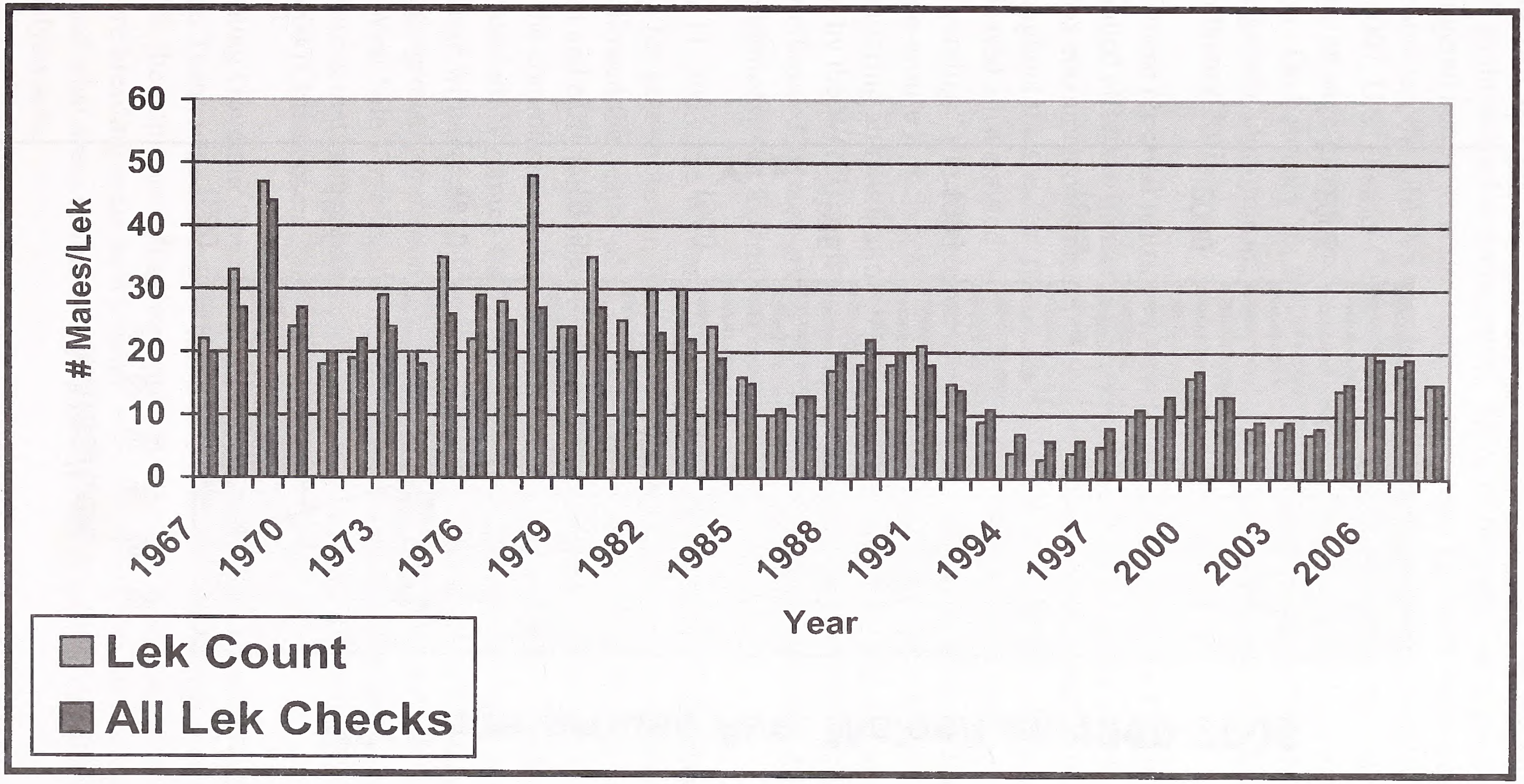
this study estimated that sage-grouse populations declined at an average rate of 0.51% per year from 1968 to 1986 (9.66% decline overall), and at an average rate of 0.33% per year from 1987 to 2003. Populations were lowest in the mid-1990s, with a gradual increase in numbers in some regions since that time (Connelly et al. 2004).

The general analysis area is within the Northeast Wyoming Local Sage-Grouse Working Group (NWLSWG) area, which includes portions of the WGFD Sheridan and Casper biological regions. Because the nearest USDA Forest Service lands are approximately 50 miles north and south of the general analysis area, this EIS does not include lek trends from the Thunder Basin National Grasslands. Results from that area are discussed in both the *South Gillette Coal Lease Application Final EIS* and the *Wright Area Coal Lease Application Draft EIS*, available on the Wyoming BLM website.

Sage-grouse monitoring has occurred in the NWLSWG area since 1967. Assuming the number of males per active lek accurately reflects sage-grouse populations, population trends have exhibited a cyclical pattern within this area. Periodic highs and lows in grouse numbers have occurred at approximately 10-year intervals (figure 3.10-1). With the exception of the most recent cycle, each successive peak was lower than the preceding peak; the same was true for successive low counts. This long-term trend suggests a steadily declining sage-grouse population (WGFD 2008b).

Comparisons between sage-grouse population trends in the NWLSWG area and statewide (figure 3.10-2) show strong similarities, though the average number of males per lek in the regional area has been lower than that observed statewide in most years. As in the NWLSWG area, the statewide sage-grouse population trend has exhibited a long-term (1960–2008) decline, a mid-term (1999–2008) increase, and a recent short-term (2006–2008) decline (WGFD 2008c). The mid- and short-term trends in statewide populations are believed to be largely weather related. Timely precipitation in some years resulted in improved habitat conditions, allowing greater numbers of sage-grouse to hatch and survive. Conversely, multi-year drought conditions are believed to have caused lower grouse survival in the early 2000s, leading to population declines.

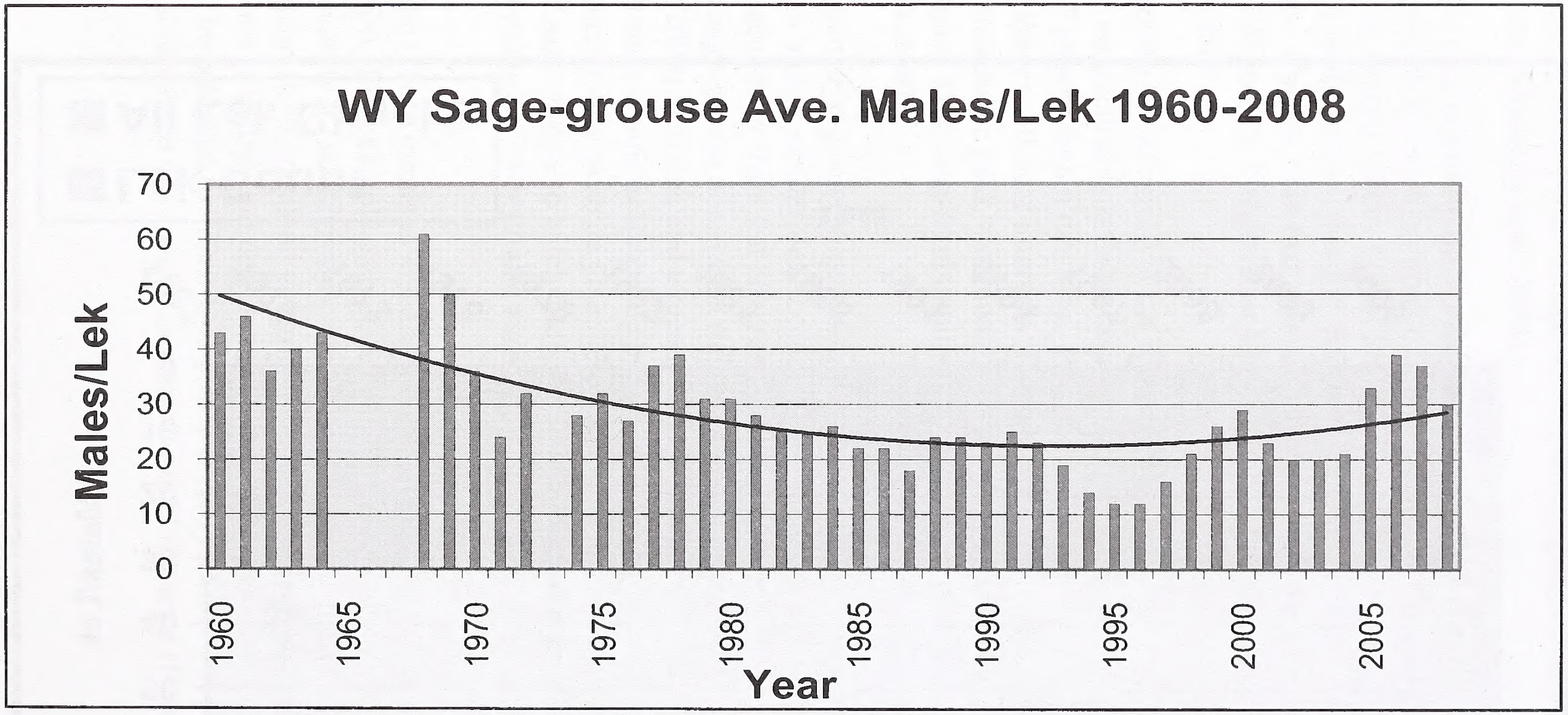
The WGFD considers these trends as valid at the statewide scale, but more varied at the local scale (WGFD 2008c). For example, sub-populations in areas more heavily influenced by anthropogenic impacts (e.g., subdivisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, interstate highways) have experienced declining populations or extirpation despite recent population increases in other parts of the state (WGFD 2008c). The potential for West Nile virus, as well as loss of population connectivity, represent additional threats to this species in many parts of its range (Naugle et al. 2004).



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.10-1

Average Male Sage-grouse Lek Attendance within the Northeast Wyoming Local Working Group Area (1968–2006)



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.10-2

Average Number of Males per Lek Counted in Wyoming (1960–2008) with a Minimum of 100 Leks Checked Each Year

Agency Responses to Sage-Grouse Population Trends

Since 1999, the USFWS has received eight petitions requesting that the sage-grouse be listed under the ESA as threatened or endangered. Three of the petitions requested that sage-grouse be listed as endangered across its entire range. On January 12, 2005, following a 12-month status review on the species, the USFWS concluded that listing was not warranted at that time. On December 4, 2007, U.S. District Court, District of Idaho, ruled that the USFWS 12-month petition finding on sage-grouse was in error and remanded the case back to the agency for further reconsideration. On February 26, 2008, the USFWS announced the initiation of another status review for the greater sage-grouse; that review process has been extended and is expected to conclude in February 2010.

In response to these repeated petitions for listing under the ESA, the USFWS has indicated the need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis. That agency has encouraged continued development and implementation of conservation strategies throughout the species' range. In May 2002, the USFWS office in Cheyenne, Wyoming, released a list entitled "Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming," which replaced the previous "Migratory Birds of High Federal Interest List." The sage-grouse is included as a Level I species on the updated list, which indicates the need for a monitoring and mitigation plan for this species. Although the sage-grouse continues to be managed by the WGFD, its inclusion on the revised list gives further impetus to ongoing annual survey efforts. The sage-grouse is also a BLM sensitive species (see appendix J) due to its recurring presence in the federal listing process.

On September 11, 2003, the Wyoming Game and Fish Commission announced that the 2003 hunting season for sage-grouse in Johnson, Sheridan, and Campbell counties would be closed. The closure followed the deaths of 11 sage-grouse in northeastern Wyoming from West Nile virus in August and early September of that year. According to WGFD's September 11, 2003, press release, the commission took this action because the incidence of infection was much higher in northeastern Wyoming than in the rest of the state, and the area is on the fringe of sage-grouse range with marginal, fragmented habitat. Recent lek count data indicate that Wyoming's sage-grouse populations increased slightly from 2004 through 2007. Lower incidences of West Nile Virus mortalities were also documented in those years, primarily due to cooler temperatures that reduced mosquito populations. Sage-grouse hunting seasons were reopened in 2004 (Christiansen 2004).

In 2007, Wyoming Governor Dave Freudenthal commissioned a Statewide Sage-grouse Implementation Team, which emerged from the Governor's 2007 Sage-Grouse Summit. On March 17, 2008, the implementation team preliminarily identified and mapped recommended sage-grouse core breeding areas in Wyoming in an effort to better understand the types of habitat grouse prefer and what areas should be protected. No such habitat was defined in the vicinity of the general analysis area.

On August 1, 2008, the Governor of Wyoming released an executive order regarding sage-grouse core area protection (Office of the Governor of Wyoming 2008) on state trust lands.

The sage-grouse core area protection concept came about because of work by the Sage-Grouse Implementation Team. The implementation team developed a core population strategy for the state "to maintain habitats and viable populations of sage-grouse in areas where they are most abundant." As part of that effort, the team delineated approximately 40 areas of state trust lands around Wyoming with a goal of maintenance and enhancement of grouse habitats and populations within the core areas. The areas were delineated by evaluating habitats within a 4-mile radius of selected sage-grouse leks in high lek-density areas.

The BLM Wyoming State Office is in the process of developing a statewide sage-grouse management policy and has incorporated sage-grouse focus areas based on the core area concept in the draft management policy. The BLM has indicated that the sage-grouse management strategy for future surface disturbance, which would include the Proposed Action and alternatives, will likely be based on the sage-grouse focus areas (BLM 2008d).

Grouse History at the Buckskin Mine

Based on results from annual counts and lek searches conducted for the Buckskin Mine, grouse occur but are not abundant in the general analysis area. In general, sharp-tailed grouse do not appear to be as prevalent as sage-grouse near the surface coal mines in northeast Wyoming. However, sharp-tailed grouse have been seen in greater numbers and with more frequency than sage-grouse in the general analysis area in recent years, though counts for both species have declined over time (table 3.10-2).

Table 3.10-2. Peak Grouse Attendance at Leks in the Vicinity of Buckskin Mine (1984–2008)

	Daly SAGR		Hay Creek SAGR*[1]		McGee SAGR[2]		Stickel STGR*		McGee I STGR		McGee II STGR*		McGee III STGR**	
Year	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1984	20	1	2	U	—	—	—	—	—	—	—	—	—	—
1985	20	4	8	U	—	—	—	—	—	—	—	—	—	—
1986	12	0	12	U	—	—	—	—	—	—	—	—	—	—
1987	10	0	23	U	—	—	—	—	—	—	—	—	—	—
1988	17	0	27	U	—	—	—	—	—	—	—	—	—	—
1989	16	5	15	1	—	—	—	—	—	—	—	—	—	—
1990	9	1	12	1	—	—	—	—	—	—	—	—	—	—
1991	10	1	17	0	—	—	—	—	—	—	—	—	—	—
1992	7	1	20	5	—	—	—	—	—	—	—	—	—	—
1993	0	0	U	U	—	—	—	—	—	—	—	—	—	—
1994	0	0	U	U	—	—	—	—	—	—	—	—	—	—
1995	0	0	0	0	—	—	—	—	—	—	—	—	—	—
1996	0	0	0	0	—	—	—	—	—	—	—	—	—	—
1997	0	0	0	0	—	—	—	—	—	—	—	—	—	—

	Daly SAGR		Hay Creek SAGR*[1]		McGee SAGR[2]		Stickel STGR*		McGee I STGR		McGee II STGR*		McGee III STGR**	
Year	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1998	0	0	0	0	—	—	—	—	—	—	—	—	—	—
1999	0	0	0	0	—	—	—	—	5	0	—	—	—	—
2000	0	0	0	0	—	—	13	1	8	0	—	—	—	—
2001	0	0	2	3	6	2	9	3	4	0	—	—	—	—
2002	0[3]	0	0	0	0	0	3	0	0	0	13	5	—	—
2003	0	0	0	0	1	3	0	0	0	0	8	1	—	—
2004	0	0	0	0	3	0	0	0	0	0	2	0	—	—
2005	0	0	0	0	0	0	0	0	0	0	0	0	4[4]	0
2006	0	0	0	0	U	U	0	0	0	0	0	0	0	0
2007	0	0	U	U	U	U	U	U	0	0	0	0	0	0
2008	0	0	0	0	0	0	U	U	0	0	0	0	0	0
Mgt. Status[5]	Abandoned		Occupied		Occupied		Occupied		Occupied		Occupied		Occupied	

M= Male; F = Female; SAGR = sage-grouse; STGR = sharp-tailed grouse; U = Unknown; --- = lek undiscovered

* In the Buckskin Mine permit area.

** In the general analysis area.

1 The lek was beyond the required annual monitoring area until 2002 but was checked at least once in most years.

2 The lek is beyond the required annual monitoring area; data presented is from the 2008 WGFD lek database.

3 Two displaying males were seen once approximately 1,000 feet south of the historic lek site. The birds were presumed to have flown in from another lek located 2.0 miles south of the Daly lek site.

4 Birds were not displaying; number of males and females unknown.

5 Management status based on WGFD (2006) classifications.

Four sharp-tailed grouse leks have been identified in the vicinity of the Buckskin Mine (table 3.10-2). All four are considered occupied under the WGFD management status classification system, though they have all been inactive for the last three years. No sharp-tailed grouse have ever been observed on the proposed tract, though flocks of as many as a dozen birds have infrequently been recorded in the winter feeding in fallow agricultural fields and perched in the tree shelterbelt near the junction of the Collins and McGee roads within the general analysis area. No sharp-tailed grouse have been seen in those locations since at least 2003. No nests or young of this species have ever been documented in the vicinity of the Buckskin Mine.

As indicated, no sharp-tailed grouse leks are present in the proposed tract. Two leks (McGee II and McGee III) are located in the general analysis area. The McGee II lek is in the overlap with the existing Buckskin Mine permit area, and the McGee III lek is immediately north of that boundary (map 3.10-1). The McGee I sharp-tailed grouse lek is approximately 0.25 mile north of the general analysis area, on the far side of a ridge and approximately 50 feet from the McGee Road. The Stickel lek is in the existing permit area, approximately 0.75 mile southeast of the general analysis area; that lek has been or will be impacted by previously permitted mine disturbance.

The greatest number of male sharp-tailed grouse recorded in the vicinity of the mine in a given year occurred in 2000, when 13 birds were seen at the Stickel lek and 8 were observed at the McGee I lek (table 3.10-2). However, sharp-tailed grouse counts declined steadily after 2000, and none were found during any lek monitoring or search efforts conducted after 2005. Given the proximity of the three McGee lek sites to one another, and the fact that grouse were never seen at two leks within that complex in the same year, it is likely that the birds were merely shifting their display sites periodically based on vegetative conditions or other unknown factors, while remaining in the same general area. Similar occurrences at sharp-tailed grouse leks have been observed elsewhere in the region. The Stickel lek may have been part of the McGee complex, as well.

Three sage-grouse lek sites have been documented at the Buckskin Mine over the last 25 years of annual monitoring (table 3.10-2); none of these sites is within the general analysis area (map 3.10-1). The Daly sage-grouse lek has been inactive for the last 16 consecutive years and is considered abandoned by the WGFD. The remaining two leks have also been inactive in recent years, but are still classified as occupied. The Hay Creek lek is within the existing Buckskin Mine permit area, approximately 0.5 mile southeast of the general analysis area. This site has been or will be affected by previously permitted disturbance in the permit area. The McGee sage-grouse lek is approximately 1.25 miles north of the general analysis area, and the abandoned Daly lek site is approximately 0.75 mile west of the permit area and on the far side of U.S. Highway 14-16.

The Daly sage-grouse lek has been monitored annually since 1984 (table 3.10-2). The greatest number of males recorded there was 20 in both 1984 and 1985. Peak male counts vacillated over the next seven years, but attendance gradually declined through 1992. No grouse were observed at the lek itself from 1993 through 2008. Two males were seen displaying approximately 1,000 feet south of the historic Daly lek site on one occasion in late April 2002, but no grouse were recorded in that area during subsequent surveys through 2008. Those two birds were presumed to have flushed from an active lek site approximately 2 miles south of the Daly lek.

The Hay Creek sage-grouse lek is located in the northeastern corner of the existing Buckskin Mine permit area. The lek was active every year from 1984 through 1992, with a peak count of 27 males in 1988. The site was not visited in 1993 or 1994, but no birds were observed during periodic checks from 1995 through 2000. Through 2000, the lek site was beyond the required annual monitoring area (existing permit boundary and 1-mile radius) for the Buckskin Mine; the mine surveyed the lek voluntarily during this period. Annual monitoring of the Hay Creek lek resumed from 2001 through 2008. Two displaying males and three hens were seen at the lek on one morning in 2001, but no grouse were present during subsequent checks that year, or in the following seven years.

The McGee sage-grouse lek is located beyond the required annual monitoring area for the Buckskin Mine and, therefore, is not included in that monitoring program. A WGFD biologist first recorded the lek in 2001. Biologists with that agency monitored the lek each year through 2005 and again in 2008. The peak male count during that period was the original six birds

discovered in 2001. No grouse were seen at the McGee sage-grouse lek during three of the six survey years, though the landowner reported birds present there in 2008 (the WGFD count was zero during three separate counts that year).

No grouse nests have been encountered in the general analysis area. No grouse broods for either species were recorded in the general analysis area during targeted surveys or incidental to surveys for other species. No sage-grouse have been observed during winter, though site visits occur less often at that time of year. No sharp-tailed grouse have ever been observed on the proposed tract during any season, though flocks of as many as a dozen birds have infrequently been recorded in the general analysis area, feeding in fallow agricultural fields and perched in the tree shelterbelt near the junction of the Collins and McGee county roads in winter. No sharp-tailed grouse have been seen in those locations since at least 2003.

As described in section 3.10.1.1, sagebrush habitat is limited to 302 noncontiguous acres in the general analysis area (including 46 noncontiguous acres in the proposed tract; these acreages represent less than 11% of the total vegetative cover for each area. Water sources in the general analysis area are limited to the diverted channel of the ephemeral drainage of Hay Creek, two small impoundments, and a playa. Of those, only one small impoundment is present in the proposed tract itself. All water bodies are seasonal, with water typically present in spring but dry by mid- to late summer.

3.10.6.2 Environmental Consequences

Given the dominant vegetation types in the general analysis area (upland grasslands and agricultural fields) and the lack of regular sightings over the last 25 years of monitoring, especially outside the breeding season, it is unlikely that either the sharp-tailed grouse or sage-grouse is a yearlong resident of the general analysis area.

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have short-term, minor to moderate impacts on upland game bird populations in the area; no grouse lek sites would be directly affected. Ongoing impacts on potential upland game bird habitats from current facilities and mining techniques would be the same as those described above under "Affected Environment," but would continue for two years beyond the current life-of-mine estimate.

No grouse leks, nests, broods, or other signs of use (feathers, droppings, snow tracks) have been documented within the proposed tract during the last 25 years of monitoring. The proposed tract does not provide any unique habitat for these four upland game bird species. The mourning dove is the only species ever recorded in the proposed tract. Mining the proposed tract would affect known habitat for mourning doves, and potential habitat for gray partridge, sharp-tailed grouse, and/or sage-grouse to varying degrees. For example, the prevalence of grasslands and limited presence of surface water in the proposed tract limits its value to sagebrush obligates such as the sage-grouse. The only group of trees (potential habitat for doves and roosting sharp-tailed grouse) in the proposed tract also overlaps the existing permit area and, thus, would be disturbed

by previously permitted activities. The upland grasslands that dominate the proposed tract are better suited for gray partridge, an introduced species, but no partridge have been documented in the proposed tract. Because the proposed tract is dominated (71%) by upland grasslands, the establishment of reclaimed grassland communities after mining has been completed would not result in a dramatic change in habitat types from the premining conditions.

Some evidence has been documented that sage-grouse do repopulate areas after reclaimed shrublands have become established, but that process may take decades (Braun 1998). Estimates for the time it would take to restore shrubs, including sagebrush, to premine density levels range from 20 to 100 years, which may delay sage-grouse repopulation in the reclaimed areas. Once they do return to an area, sage-grouse populations do not appear to attain their previous levels.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on upland game birds and habitat, including grouse lek sites, in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would be associated with activities necessary to support mining on existing leases, as described in section 1.1.3.3. Those impacts would be short-term and moderate, with disturbance and reclamation occurring incrementally in the area. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

No sage-grouse leks are present in the general analysis area, but one site is approximately 0.5 mile southeast of that area, within the existing mine permit area (map 3.10-1).

Three occupied sharp-tailed grouse leks have been or would be affected by previously permitted mine activities under the No Action Alternative. One sharp-tailed grouse lek is located in the overlap between the general analysis area and the permit area (map 3.10-1) and another lek is immediately north of that common area. The third sharp-tailed grouse lek is elsewhere within the Buckskin Mine permit area, approximately 0.75 mile southeast of the general analysis area.

No grouse nests or broods for either species have been documented in the overlap between the general analysis area and permit boundary, nor have grouse been observed in that area during winter. Both lek sites outside the general analysis area but within the existing permit area have been or would be affected by previously permitted mine activities on existing leases.

The tree windbreak in the overlap between the general analysis area and existing permit area represents potential nesting and/or roosting habitat for mourning doves and sharp-tailed grouse. As described previously, these trees would be impacted by mine disturbance under any of the alternatives considered in this EIS. Little sagebrush is present in the general analysis area, including its overlap with the existing permit area. Therefore, the establishment of reclaimed grassland communities after mining has been completed would not result in a dramatic change in habitat types from the premining landscape.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration, would have short-term, minor to moderate impacts on upland game birds due to their limited documented presence in the area. Impacts on known and potential upland game bird habitats from current facilities and mining techniques would be the same as those described above under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

No sage-grouse leks occur within the general analysis area (map 3.10-1). The nearest sage-grouse lek (Hay Creek) is within the existing permit area approximately 0.5 mile to the southeast and, thus, is already subject to disturbance from previously permitted activities. The McGee sage-grouse lek is on private surface approximately 1.25 miles north of the general analysis area. That site is on the far side of multiple ridges that provide a visual and audio buffer, and it is not likely to be affected by mine operations. Sage-grouse were last observed at the Hay Creek lek in 2001 and the McGee lek in 2004; both are considered occupied by the WGFD.

Two occupied sharp-tailed grouse leks have been documented in the general analysis area over the last 25 years of annual monitoring (map 3.10-1). As described previously, the McGee II lek is in the overlap area with the current permit area and the McGee III lek is immediately north of the overlap area. Due to their locations, those leks have been or would be disturbed by previously permitted mining of existing leases. The McGee I sharp-tailed grouse lek is approximately 0.25 mile north of the general analysis area. It would not be in view of the general analysis area due to the ridgeline that separates the two sites, but it could be affected by noise from within the general analysis area. The Stickel lek is approximately 0.75 mile southeast of the general analysis area and within the existing permit area; this site has been or would be disturbed by previously permitted activities on existing leases. Sharp-tailed grouse were last recorded at the McGee II lek in 2004 and the McGee III lek in 2005. The McGee I lek was last active in 2001, and the Stickel lek in 2002.

Disturbance and reclamation activities would be temporary and occur incrementally throughout the area. If mining activities disturb a lek, grouse would have to use an alternate site or establish a new lek for breeding activities.

In addition to lek sites, areas of suitable habitat for nesting are needed to sustain sage-grouse populations. One recent study suggests that availability of winter habitat may also affect sage-grouse populations (Naugle et al. 2006). The general analysis area is dominated (71% of total cover) by upland grasslands and agricultural fields, which do not provide the necessary shrub communities for forage and cover. No grouse nests or broods have been documented in the general analysis area, nor have grouse been observed there during winter. Additionally, the general analysis area is not included in or within several miles of either a state sage-grouse core area or BLM sage-grouse focus area, though that does not preclude the need for grouse management when they are present.

The general analysis area does not provide any unique habitat for these four upland game bird species, and future mine operations would affect existing and potential habitat to varying degrees. As described previously, the prevalence of upland grasslands and the limited presence of surface water reduce the area's value to sagebrush obligates such as the sage-grouse. The only group of trees (potential habitat for doves and roosting sharp-tailed grouse) in the area that is not adjacent to an occupied or recently vacated residence also overlaps the existing permit area and, thus, would be impacted by previously permitted activities regardless of the leasing decision. The upland grasslands and agricultural fields that dominate the area are well suited for gray partridge, an introduced species to this country, but no partridge have been documented in the general analysis area.

Leasing, mining, and reclaiming a tract within the general analysis area would result in permanent, alterations in the topography and long-term changes in vegetative composition from premine conditions. Because the general analysis area is dominated (71%) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats, respectively, compared to those in the premining landscape. Restoration of sagebrush communities that are present could be difficult to accomplish through artificial plantings, and can take decades through natural regeneration. Until sagebrush returns to its premining density, a reduction in potential habitat for wildlife species associated with that habitat would occur in the general analysis area.

Some evidence has been documented that sage-grouse do repopulate areas after reclaimed shrublands have become established, but that process may take decades (Braun 1998). Estimates for the time it would take to restore shrubs, including sagebrush, to premine density levels range from 20 to 100 years, which may delay sage-grouse repopulation in the reclaimed areas. Once they do return to an area, sage-grouse populations do not appear to attain their previous levels.

3.10.7 Other Birds

3.10.7.1 Affected Environment

The USFWS uses a list entitled the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming* (table 3.10-3) for reviews related to existing and proposed surface coal mining (USFWS 2002). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2001), and was current through 2008. The USFWS considers Level I species as in need of conservation action, which includes having a monitoring and mitigation plan for those birds. Continued monitoring is recommended, but not required, for Level II species.

Table 3.10-3. Forty Migratory Bird Species of Management Concern for Wyoming Coal Mines: Historical Occurrence and Status in or within 0.5 Mile of the Buckskin Mine Permit Area[1] (2006–2008)

Species[2]	Historical Occurrence in the Vicinity of the Buckskin Mine[3]	2006	2007	2008
LEVEL I				
Mountain plover* *Charadrius montanus*	never recorded	—	—	—
Greater sage-grouse* *Centrocercus urophasianus*	occasional breeder	potential breeder	—	—
McCown's longspur* *Calcarius mccownii*	rarely observed	—	observed	—
Baird's sparrow *Ammodramus bairdii*	never recorded	—	—	—
Ferruginous hawk* *Buteo regalis*	historic breeder	—	—	observed
Brewer's sparrow* *Spizella breweri*	regular breeder (beyond general analysis area)	presumed breeder	presumed breeder	presumed breeder
Sage sparrow *Amphispiza belli*	never recorded	—	—	—
Swainson's hawk* *Buteo swainsoni*	rare breeder	—	potential breeder	—
Long-billed curlew *Numenius americanus*	infrequent spring migrant	—	—	—
Short-eared owl* *Asio flammeus*	infrequently observed	breeder	—	observed
Peregrine falcon *Falco peregrinus*	never recorded	—	—	—
Burrowing owl* *Athene cunicularia*	rare breeder	—	—	—
Bald eagle *Haliaeetus leucocephalus*	occasional in winter	limited winter resident	limited winter resident	limited winter resident
Upland sandpiper* *Bartramia longicauda*	infrequently observed	—	—	—
LEVEL II				
Cassin's kingbird *Tyrannus vociferans*	never recorded	—	—	—
Lark bunting* *Calamospiza melanocorys*	common breeder	presumed breeder	presumed breeder	presumed breeder
Dickcissel *Spiza americana*	never recorded	—	—	—
Chestnut-collared longspur* *Calcarius ornatus*	rarely recorded	—	—	—
Black-chinned hummingbird *Archilochus alexandri*	never recorded	—	—	—
Pygmy nuthatch *Sitta pygmaea*	never recorded	—	—	—

Species[2]	Historical Occurrence in the Vicinity of the Buckskin Mine[3]	2006	2007	2008
Marsh wren *Cistothorus palustris*	never recorded	—	—	—
Western bluebird *Sialia mexicana*	never recorded	—	—	—
Sage thrasher* *Oreoscoptes montanus*	rarely observed	—	observed once	—
Grasshopper sparrow* *Ammodramus savannarum*	occasional breeder	potential breeder	potential breeder	presumed breeder
Bobolink *Dolichonyx oryzivorus*	never recorded	—	—	—
Common loon *Gavia immer*	never recorded	—	—	—
Black-billed cuckoo *Coccyzus erythropthalmus*	never recorded	—	—	—
Red-headed woodpecker *Melanerpes erthrocephalus*	never recorded	—	—	—
Yellow-billed cuckoo *Coccyzus americanus*	never recorded	—	—	—
Eastern screech-owl *Megascops asio*	never recorded	—	—	—
Western screech-owl *Megascops kennicottii*	never recorded	—	—	—
Western scrub-jay *Aphelocoma coerulescens*	never recorded	—	—	—
Loggerhead shrike* *Lanius ludovicianus*	occasional breeder	potential breeder	potential breeder	—
Vesper sparrow* *Pooecetes gramineus*	common breeder	presumed breeder	presumed breeder	presumed breeder
Lark sparrow* *Chondestes grammacus*	occasional breeder	—	potential breeder	—
Ash-throated flycatcher *Myiarchus cinerascens*	never recorded	—	—	—
Bushtit *Psaltriparus minimus*	never recorded	—	—	—
Merlin* *Falco columbarius*	rarely observed	—	—	—
Sprague's pipit Anthus spragueii	never recorded	—	—	—
Barn owl *Tyto alba*	never recorded	—	—	—

[1] The survey area for the Buckskin Mine overlapped the entire proposed tract and much of the general analysis area in most years (from 1984-2008). Both areas were completely covered during baseline studies conducted from 2007 through 2008.

[2] Species are arranged in descending priority within each level as assigned in the Wyoming Bird Conservation Plan (Cerovski et al. 2001). Level I indicates a clear need for conservation action. Level II represents a need for continued monitoring.

[3] Historical occurrence in the Buckskin Mine survey area is based on records from baseline or monitoring studies conducted at the mine (1984-2008).

* Species noted with an asterisk regularly nest in the Powder River Basin.

The Buckskin Mine has conducted specific surveys for migratory birds of concern annually since at least 1993, incorporating new lists and survey protocols (breeding bird point counts) as they were issued. These surveys have been conducted in both spring and summer to detect both migrating and breeding birds. Beginning in 2006, annual point count surveys for breeding bird (primarily passerines) were conducted per a request by the USFWS Ecological Services Office in Cheyenne, Wyoming. Survey efforts used a fixed-radius circular plot method adapted from Reynolds et al. (1980). Although these surveys are not included in either Appendix B, results are included in the annual for the Buckskin Mine each year. These survey methods and areas are in accordance with the USFWS approved Avian Monitoring and Mitigation Plan for the Buckskin Mine.

As described in section 3.10.2, the annual monitoring survey area for most migratory bird species of concern includes the existing permit area and a 0.5-mile radius. Because they are protected under one or more federal laws, the survey area for bald eagles and other raptor species is expanded to a 1-mile radius. The annual monitoring survey area for sage-grouse is also a 1-mile radius, but leks within 3 miles of the general analysis area were considered for this EIS to meet BLM concerns about this species.

Due to the proximity of the general analysis area to the existing Buckskin Mine permit area, the entire tract has been included in annual surveys for avian species of concern since at least 1993, with significant coverage in the general analysis area during that period. Results from surveys conducted for migratory birds at the Buckskin Mine are available in baseline and annual wildlife reports, on file with the WDEQ/LQD in Sheridan, Wyoming. Those reports include a tabulation of the regional status, expected occurrence, historical observations, and breeding records for each species on the current list of avian species of concern for a given report year, as well as two or more preceding years; additional information for each species observed in a given year is also included in each report.

Table 3.10-3 provides a tabulation of the regional status and expected occurrence, historical observations, and breeding records for each of the species on the "Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming," based on a compilation of the results of the annual surveys conducted for the Buckskin Mine from 2006 through 2008. Eighteen of the 40 listed species have historically been observed in the migratory bird survey area, though they may not have been seen in the general analysis area: 10 Level I species and 8 Level II species. None of the Level I species regularly breed in the general analysis area, though they are often recorded elsewhere in the survey area. Twenty-two of the 40 avian species of concern have never been recorded in the general analysis area or Buckskin Mine permit area: 4 Level I and 18 Level II species. Some raptor species of management concern, including species that nest in the general analysis area, are discussed in section 3.10.5. Sage-grouse are discussed in section 3.10.6.

The most frequently recorded nesting species in the migratory bird survey area are the lark bunting (*Calamospiza melanocorys*), vesper sparrow (*Pooecetes gramineus*), and grasshopper sparrow (*Ammodramus savannarum*). All three of those species are considered Level II. The

Brewer's sparrow (*Spizella breweri*), a Level I species, often nests in sagebrush stands in unmined portions of the existing permit area, beyond the general analysis area. Five additional species have nested (including failed attempts) less often in the area, including the Swainson's hawk, sage-grouse, short-eared owl, loggerhead shrike (*Lanius ludovicianus*), and lark sparrow (*Chondestes grammacus*); the grouse and both raptor species are considered Level I. The bald eagle is only observed in the winter or as a migrant. The other eight species have been observed infrequently (table 3.10-3).

The mountain plover is included on the "Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming." The USFWS proposed listing the mountain plover as a threatened species in February 1999 but withdrew the proposal in September 2003 (USFWS 2008). The agency continues to encourage provisions that would provide protection for this species, as it continues to be protected under the Migratory Bird Treaty Act and as a sensitive species under BLM policy (Bureau Manual 6840.06 E. Sensitive Species). This species has not been documented in within the migratory bird survey area; nor was it documented during other wildlife surveys conducted for the Buckskin Mine.

Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. No bald eagle winter roosts have ever been documented in the bald eagle survey area, though potential winter roosting habitat for this species is present. That habitat consists of isolated cottonwood shelterbelts in the general analysis area, as described in section 3.9. No known bald eagle nests, or consistent yearly concentrated prey or carrion sources (e.g., sheep, fisheries) for bald eagles have been documented in the bald eagle survey area.

The bald eagle was more common and abundant in the area during winters from 2004 through 2007 than in previous years. This may have been a result of mild winters and the abundance of lagomorphs (rabbits) to prey upon. Bald eagles also scavenged road-killed rabbits off of adjacent roads. Rabbit numbers appeared to be at or near a peak in their cycle during those years. During those winters, one or two bald eagles occasionally used the shelterbelt is in the overlap area between the general analysis area and existing Buckskin Mine permit area. Bald eagles had never been observed concentrating in this windbreak during the previous two decades of wildlife surveys. No bald eagles have ever been documented in the tree shelterbelt around the recently vacated residence near the junction of the Collins and McGee roads in the general analysis area, or the shelterbelt surrounding the occupied residence between the two roads. A single adult bald eagle was observed once perched in an isolated cottonwood just south of the latter residence. As noted, bald eagle sightings within the Buckskin Mine survey area averaged only 0.5 per year over the last 25 years (1984–2008).

The burrowing owl is uncommon at the Buckskin Mine and has never been observed in the general analysis area. This species is an infrequent breeder in the prairie dog colony just beyond the northeastern corner of the general analysis area.

The sage-grouse was recently added to the Level I list of avian species of concern at coal mines. This species is becoming less common in the vicinity of the Buckskin Mine, as described in section 3.10.6. No sage-grouse leks are present in the general analysis area, and sage-grouse

have not been recorded in either area during the last 25 years of annual monitoring. Both areas are dominated by upland grassland habitats, with only 11% (46 and 302 noncontiguous acres, respectively) of their areas comprised of sagebrush habitats. Suitable nesting habitat is scarce if not absent in the general analysis area for the remainder of the "Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming;" therefore, the other species have rarely or never been recorded.

Under natural conditions, limited seasonal waterfowl and shorebird habitat is present in the general analysis area. Prior to CBNG development, the natural aquatic habitat in the general analysis area was mainly available during spring migration as a single ephemeral stream, two stock impoundments, and a closed-basin playa. All of these water features generally were quite low or dry after spring. The relatively recent development of CBNG resources upstream and within the general analysis area has enhanced surface water availability to some degree resulting in a limited increase in habitat for waterfowl and shorebird species. However, all water bodies within the general analysis area continue to be dry or nearly so by mid-summer in most years; exceptions occur during years with above average precipitation.

The adjacent Buckskin Mine has conducted a voluntary program of waterfowl and shorebird monitoring at various native and reclaimed water bodies in the existing permit area. Multiple surveys were conducted in spring and summer each year since 2004. Those surveys did not include the playa located between the Collins and McGee roads, the largest and most persistent water body in the general analysis area, but it did include a similar playa in the mine permit area, approximately 1.25 miles south of the general analysis area. Both playas have been enhanced by CBNG discharge water in recent years. Common species seen at the playa within the permit area include the Canada goose (*Branta Canadensis*), American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), and green-winged teal (*Anas crecca*), along with common shorebirds such as the killdeer (*Charadrius vociferus*) and spotted sandpiper (*Actitis macularia*). Similar species have been or would be expected to be recorded at the playa in the general analysis area.

3.10.7.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have no new impacts on migratory bird species of management concern in Wyoming; impacts on waterfowl and shorebirds would be negligible. Ongoing impacts from current facilities and mining techniques would be the same as those described above under "Affected Environment," but would continue for two years beyond the current life-of-mine estimate; these impacts are short-term and minor to moderate, and occur incrementally through the area.

None of the 18 migratory bird species of management concern for Wyoming coal mines that have historically been observed in the migratory bird survey area are regularly seen in the

proposed tract. The upland grasslands that dominate the tract lack the specific characteristics (shrubs, wetlands, prairie dog colonies, or shorter, less dense grasses) typically associated with most Level I species that have historically been recorded in the area. No sage-grouse leks are present in the proposed tract. The bald eagle is the only avian species of concern that has been recorded in the proposed tract. This species has been documented fewer than 0.5 times per year in the vicinity of the Buckskin Mine, with even fewer observations in the tree grove in the overlap between the proposed tract and existing permit area. That shelterbelt is already subject to mine related disturbance from previously permitted activities on existing leases. Additional potential impacts on the sage-grouse and raptors in general, as well as measures in place to prevent impacts on these species from existing mining operations, were included in the preceding discussions.

The Proposed Action could have impacts on existing habitat for these species in the proposed tract and buffer. The habitat loss would be short-term for grassland species, but would last longer for shrub-dependent species. However, with less than 11% of the total composition, sagebrush is not a dominant species in those areas. Reclamation practices at Buckskin are designed to provide a mosaic of upland and bottomland habitats that would potentially host most of these species. All disturbance and reclamation efforts would occur incrementally throughout the area. Because the proposed tract is dominated (71%) by upland grassland communities, the establishment of reclaimed grasslands after mining has been completed would not result in a dramatic change in habitat types from the premining landscape. Periodic breeding bird surveys at other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between premining and postmining vegetation. Additionally, surface coal mines in the PRB of northeastern Wyoming are required to replace each tree lost to mining, though it will take many years for newly planted trees to reach maturity. Research projects on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Clayton et al. 2006; Shelley 1992).

No impacts on mountain plovers are anticipated because this species has never been documented in its survey area in the last 25 years of monitoring. Additionally, typical suitable habitat (short and sparse vegetation) for this species is not present in the general analysis area.

The Proposed Action would have a negligible effect on migrating and breeding waterfowl and shorebirds due to the limited presence and seasonal nature of open water and wetland habitats in the area. Sedimentation ponds created during mining would provide interim habitat for aquatic fauna. The current reclamation plan for the Buckskin Mine requires that the segment of the Hay Creek channel in the northern portion of the general analysis area affected by currently permitted mining be reclaimed to restore its premining functions and aquatic habitats. The diversion channel and other future diversions would not provide the same habitat as the natural channels, although natural stream flow and the presence of CBNG discharge water would not be affected. Mitigation for all impacts on jurisdictional wetlands would be required in accordance with

section 404 of the Clean Water Act (section 3.7). If new wetlands do not duplicate the exact function and/or landscape features of the premine wetlands, species associated with those habitats could be beneficially or adversely affected as a result, depending on their premine status.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on wildlife and wildlife habitat in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would be associated with activities necessary to support mining on existing leases, as described in section 1.1.3.3. Few avian species of concern have been recorded in the overlap area itself, so impacts are expected to be negligible. No trees or unique habitat features occur in that area other than Hay Creek, which has already been diverted during previously permitted activities. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration would have no new impacts on migratory bird species of management concern in Wyoming; impacts on waterfowl and shorebirds would be negligible. Impacts would be the same as or similar to those described under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

None of the 18 migratory bird species of management concern for Wyoming coal mines that have historically been observed in the vicinity are regularly seen in the general analysis area. The upland grasslands and agricultural lands that dominate the area lack the specific characteristics (shrubs, wetlands, prairie dog colonies, or shorter, less dense grasses) typically associated with most Level I species that have historically been recorded in the area. No sage-grouse leks are present in the general analysis area; the lone sage-grouse lek in the immediate vicinity is located in the existing permit area and, thus, is already subject to previously permitted disturbances. Fewer than 0.5 bald eagle sightings per year have been recorded in the entire Buckskin survey area that overlaps the general analysis area. The tree grove where bald eagles have occasionally been observed is in the overlap with the existing permit area, which is already scheduled for eventual disturbance associated with previously permitted activities. Additional potential impacts on the sage-grouse, bald eagle, and raptors in general, as well as measures in place to prevent impacts on these species from existing mining operations, were included in the preceding discussions.

Impacts on existing habitats for these species would be short-term for grassland species, but would last longer for shrub-dependent species. However, with less than 11% of the total composition, sagebrush is not a dominant species in the general analysis area. Reclamation practices at Buckskin are designed to provide a mosaic of upland and bottomland habitats that would potentially host most of these species. All disturbance and reclamation activities would occur incrementally throughout the area. Because the proposed tract is dominated (71%) by

upland grassland and agricultural lands, the establishment of reclaimed grasslands after mining has been completed would not result in a dramatic change in habitat types from the premining landscape. Periodic breeding bird surveys at other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between premining and postmining vegetation. Additionally, surface coal mines in the PRB of northeastern Wyoming are required to replace each tree lost to mining, though it will take many years for newly planted trees to reach maturity. Research projects on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Clayton et al. 2006; Shelley 1992).

No impacts on mountain plovers are anticipated because this species has never been documented in its survey area in the last 25 years of monitoring. Additionally, typical suitable habitat (short and sparse vegetation) for this species is not present in the general analysis area.

Alternative 2 would have a negligible effect on migrating and breeding waterfowl and shorebirds due to the limited presence and seasonal nature of this habitat in the area. Sedimentation ponds created during mining would provide interim habitat for aquatic fauna. The current reclamation plan for the Buckskin Mine requires that the segment of the Hay Creek channel in the northern portion of the general analysis area affected by currently permitted mining be reclaimed to restore its premining functions and aquatic habitats. The diversion channel and other future diversions would not provide the same habitat as the natural channels, although natural streamflow and the presence of CBNG discharge water would not be affected. Mitigation for all impacts on jurisdictional wetlands would be required in accordance with section 404 of the Clean Water Act (section 3.7). If the mitigated wetlands do not duplicate the exact function and/or landscape features of the premine wetlands, species associated with those habitats could be beneficially or adversely affected as a result, depending on their premine status.

Only three shelterbelts are present in the general analysis area. One stand is in the overlap with the existing Buckskin Mine permit area and the other two surround currently or recently occupied residences.

3.10.8 Amphibians, Reptiles, and Aquatic Species

3.10.8.1 Affected Environment

Wildlife surveys completed specifically for the Buckskin Mine and adjacent mines, as well as biological research projects in the eastern PRB, have documented numerous other wildlife species that inhabit the region, including various amphibians, reptiles, and aquatic species. Some of these species are common inhabitants of the wildlife survey area for the Buckskin Mine, but they have not necessarily been regularly observed in the general analysis area.

Reptile and amphibian species have been recorded during the various surveys at the Buckskin Mine and on adjacent lands, including the general analysis area. These species include the tiger salamander (*Ambystoma tigrinum*), great plains toad (*Bufo cognatus*), boreal chorus frog (*Pseudacris triseriata maculata*), eastern short-horned lizard (*Phrynosoma douglassi brevirostre*), prairie rattlesnake (*Crotalus viridis viridis*), and bullsnake (*Pituophis melanoleucas sayi*). The abundance of these reptiles and amphibians is difficult to determine but these species appear to be common to the area.

Under natural conditions, aquatic habitat is limited by the temporary nature of most surface waters in the general analysis area. The lack of deep-water habitat and extensive and persistent water sources within that region precludes the presence and diversity of fish and other aquatic species. Consequently, monitoring of aquatic species is not regularly conducted at the Buckskin Mine, and fish surveys were not required or conducted specifically for the proposed tract.

The scarcity of mesic habitats throughout the majority of the wildlife survey area for the Buckskin Mine also reduces the potential of the area to attract aquatic species. Recent influxes of CBNG discharge water into Hay Creek has provided extended periods of surface water in some, but not all, of the last few years.

3.10.8.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract (419 acres) and mining support activities (described in section 1.1.3.3.) in the buffer area to the north would have short-term, negligible to minor impacts on reptiles, with short-term, negligible impacts on amphibians and aquatic species. Ongoing impacts from current facilities and mining techniques would be the same as those described above under "Affected Environment," but would continue for two years beyond the current life-of-mine estimate.

Mining the proposed tract would remove habitat for amphibians and reptiles in some areas. Disturbance and reclamation activities would occur incrementally throughout the area. Due to the limited presence of water in the area, no fisheries and few, if any, other aquatic species would be impacted. Because the proposed tract is dominated (71%) by upland grassland communities, the establishment of reclaimed grasslands after mining would not result in a dramatic change in habitat types from the premining landscape.

Under jurisdiction of the Buckskin Mine's current WDEQ/LQD mine permit, Hay Creek has already been diverted to recover coal from the existing coal leases (section 3.5.2.1). This diversion does not impact the proposed tract. The aquatic resources of Hay Creek would be restored after mining to approximate premining conditions.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Impacts on reptiles, amphibians, and

aquatic species within the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area, and would be associated with activities necessary to support mining on existing leases, as described in section 1.1.3.3; those impacts would be negligible to minor, depending on the species. Disturbance and reclamation activities would occur incrementally throughout the area. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Water resources in the overlap area are not sufficient to support fisheries and few, if any, other aquatic species would be impacted. Under jurisdiction of the Buckskin Mine's current WDEQ/LQD mine permit, Hay Creek has already been diverted to recover coal from the existing coal leases (section 3.5.2.1). This diversion affects the northern part of the overlap between the general analysis area and existing permit area. The aquatic resources of Hay Creek would be restored after mining to approximate premining conditions.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area (up to 1,883 acres) and mining support activities (described in section 1.1.3.3.) in a 0.25-mile-wide buffer around the final tract configuration would have short-term negligible to minor impacts on reptiles, and short-term negligible impacts on amphibians and aquatic resources. Impacts would be the same as or similar to those described under the Proposed Action, but would continue for up to six years beyond the current life-of-mine estimate.

Mining in the general analysis area would remove habitat for amphibians and reptiles in some areas. Disturbance and reclamation activities would occur incrementally throughout the area. Due to the limited presence of water in the area, no fisheries and few, if any, other aquatic species would be impacted. Because the general analysis area is dominated (71% combined) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats, respectively, compared to those in the premining landscape.

Under jurisdiction of the Buckskin Mine's current WDEQ/LQD mine permit, Hay Creek has already been diverted to recover coal from the existing coal leases (section 3.5.2.1). This diversion does not impact the proposed tract, but it does span the northern part of the general analysis area. The aquatic resources of Hay Creek would be restored after mining to approximate premining conditions.

3.10.9 Threatened, Endangered, Proposed, and Candidate Animal Species, and BLM Sensitive Species

Appendix I of this document contains the biological assessment, and appendix J contains a discussion of the sensitive species evaluation.

3.10.10 Regulatory Compliance, Mitigation and Monitoring

Regulatory guidelines and requirements designed to prevent or reduce surface coal mining impacts on wildlife include:

- fencing designed to permit passage of pronghorn and other big game species to the extent possible;
- development of a monitoring and mitigation plan for raptors and other migratory bird species of management concern that must be approved by the USFWS, including the following provisions:
  - creating raptor nests and nesting habitat through enhancement efforts (nest platforms, tree plantings) to mitigate other nest sites impacted by mining operations;
  - relocating raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;
  - obtaining a permit for removal and mitigation of golden eagle nests and those of other raptor species;
  - restricting mine-related disturbances from encroaching within stipulated buffers of active raptor nests from egg-laying until fledging to prevent nest abandonment and injury to eggs or young;
  - reestablishing ground cover necessary for the return of a suitable raptor prey base after mining;
  - requiring use of raptor-safe construction for overhead power lines;
- development of a Migratory Bird Species of Management Concern for Coal Mines in Wyoming Monitoring and Mitigation Plan, which must be approved by USFWS;
- restoring sage-grouse habitat after mining including reestablishing sagebrush and other shrubs on reclaimed lands and grading reclaimed lands to create swales and depressions suitable for sagebrush obligates and their young;
- restoring diverse landforms, replacing topsoil, and constructing brush piles, snags, and rock piles to enhance habitat for wildlife;
- restoring short-grass habitat for species that nest and forage in those habitat types;
- restoring habitat provided by jurisdictional wetlands; and
- reclaiming the stream channels and restoring surface water flow quantity and quality after mining to approximate premining conditions.

The current permit for the Buckskin Mine requires reconstruction of bed form features in major stream channels, such as pools and runs, that should help restore the channels' natural function, as well as provide habitat. Restoration will be or may be achieved by salvaging sufficient material from channel terrace alluvium or material having the same physical characteristics to reconstruct pool features. Current reclamation, as well as future reclamation of Hay Creek would incorporate any alluvium salvaged from the original channel. These measures are

included in the existing mining and reclamation permit and would be included in the amended mining and reclamation plans, if either of the action alternatives is implemented.

Baseline wildlife surveys were conducted for the adjacent Buckskin Mine before mining operations began. Annual wildlife monitoring surveys have been conducted since the mid-1980s. These surveys are required by state and federal regulations, and will continue for the life of the mine; the annual survey area would be expanded to accommodate new coal leases, as needed. The mine has also voluntarily conducted annual and/or periodic surveys for additional species that are not included in the monitoring required by state or federal regulations. The wildlife monitoring surveys cover the areas included in the mine permit areas and a surrounding perimeter that varies in size according to the species being surveyed. As a result, the entire proposed tract and most of the surrounding general analysis area have been surveyed as part of the required monitoring surveys for the Buckskin Mine for many years.

The annual monitoring programs include:

- spring surveys for new and/or occupied raptor nests, upland game bird lek locations, threatened and endangered species, and migratory birds;
- late spring surveys of raptor production for occupied nests, opportunistic observations of all wildlife species, threatened and endangered species, and migratory birds;
- raptor territorial occupancy and nest productivity surveyed annually in and within a 1- or 2-mile radius of the existing permit areas;
- summer surveys for raptors, migratory birds, and lagomorph density;
- winter surveys for bald eagle winter roosts in and within 1 mile of the permit area (conducted as needed based on proximity of disturbance to potential roosting habitat);
- voluntary winter surveys for big game in and surrounding the permit area (currently conducted during alternate years);
- voluntary aquatic surveys for fish and macro-invertebrates in the existing permit area (previous annual schedule, currently conducted during alternate years);
- voluntary annual surveys for migrating and nesting waterfowl, shorebirds, and other water obligate avian species; and
- breeding bird surveys (now required annually at all mines).

Monitoring data were collected by all of the surface coal mines in the PRB for big game species from at least 1995 until 1999, with most mines conducting annual surveys since the mid- to late 1980s until the early 2000s. In 1999, the WGFD reviewed monitoring data and requirements for big game species on those mine sites. They concluded that monitoring had demonstrated a lack of impacts on big game on existing mine sites. No severe mine-caused mortalities had occurred, and no long-lasting impacts on big game had been noted on existing mine sites. The WGFD recommended at that time that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or

in significant migration corridors, neither of which are present within the proposed tract or general analysis area. Although big game surveys are no longer required as part of the annual wildlife monitoring program at the Buckskin Mine, Kiewit has voluntarily continued these surveys on a reduced but regular schedule.

The Buckskin Mine currently operates under a raptor monitoring and mitigation plan approved by the USFWS. This plan would be amended to include the final tract configuration if additional coal reserves are leased and proposed for mining. The amended raptor mitigation plan would be subject to review and approval by USFWS before the amended mining plan is approved.

A monitoring and mitigation plan for migratory bird species of management concern has also been developed in cooperation with USFWS for the existing Buckskin mining operation, and that plan would be amended to include the final tract configuration. If additional species are documented nesting or using the area regularly, a mitigation plan would be developed to protect those birds and their habitat.

3.10.11 Residual Impacts

Although the lands disturbed by future mining would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, some residual wildlife impacts would occur. The reduction in topographic variety would result in a permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species. Limited riparian and aquatic habitats are present in the general analysis area. Areas that currently support sagebrush would be altered to a grassland community, perhaps for decades, during the interim between sage plantings and maturity in reclamation. Until premining habitats have been fully reestablished, such habitat transformations would likely result in a change in wildlife species composition. Those species may repopulate reclaimed areas, but populations may not attain premining levels. The limited presence of sagebrush communities in the general analysis area would help minimize such residual impacts. Minimal residual impacts on threatened and endangered, candidate, or proposed plant and animal species would occur, because few such species have ever been recorded in the general analysis area, and state and federal regulations require reclamation of specific habitats important for these species.

3.11 Land Use and Recreation

This section discusses the affected environment and environmental consequences in the general analysis area as they relate to surface and mineral ownership, land use (private and industrial), and recreation, including impacts resulting from the Proposed Action and alternatives.

3.11.1 Affected Environment

Campbell County does not have a countywide land use plan, but has been working on a comprehensive land use plan jointly with the City of Gillette. The City of Gillette's land use

plan, *City of Gillette/Campbell County Comprehensive Planning Program*, provides general goals and policies for land use in the county, including state and federal coal leases, and is an integral part of the overall plan for Campbell County (City of Gillette 1978). The proposed lease area does not have a designated zoning classification.

The entire surface of the existing Buckskin Mine permit area and general analysis area is privately owned by individuals or companies (map 3.11-1), while most of the subsurface minerals (all of the coal and the majority of oil and gas reserves) are federally owned (map 3.11-2). All oil and gas production facilities located in the proposed tract are privately owned; facilities in the rest of the general analysis area under a mix of federal and private ownership. Section 3.11.1.1 provides additional information about mineral ownership.

Wildlife habitat and livestock grazing are the primary present and historical land uses in the general analysis area. Secondary land uses include pastureland (ranching), dryland cropland, transportation, and CBNG development. Coal mining at the Buckskin Mine is and has been the dominant land use to the east and south of the general analysis area since the mid-1980s.

In addition to existing surface disturbance associated with the Buckskin Mine, the general analysis area includes small crop areas, two Campbell County roads (the Collins and McGee roads), several overhead electric transmission lines, oil and gas pipelines, and three residences. Only one of the three residences is currently occupied.

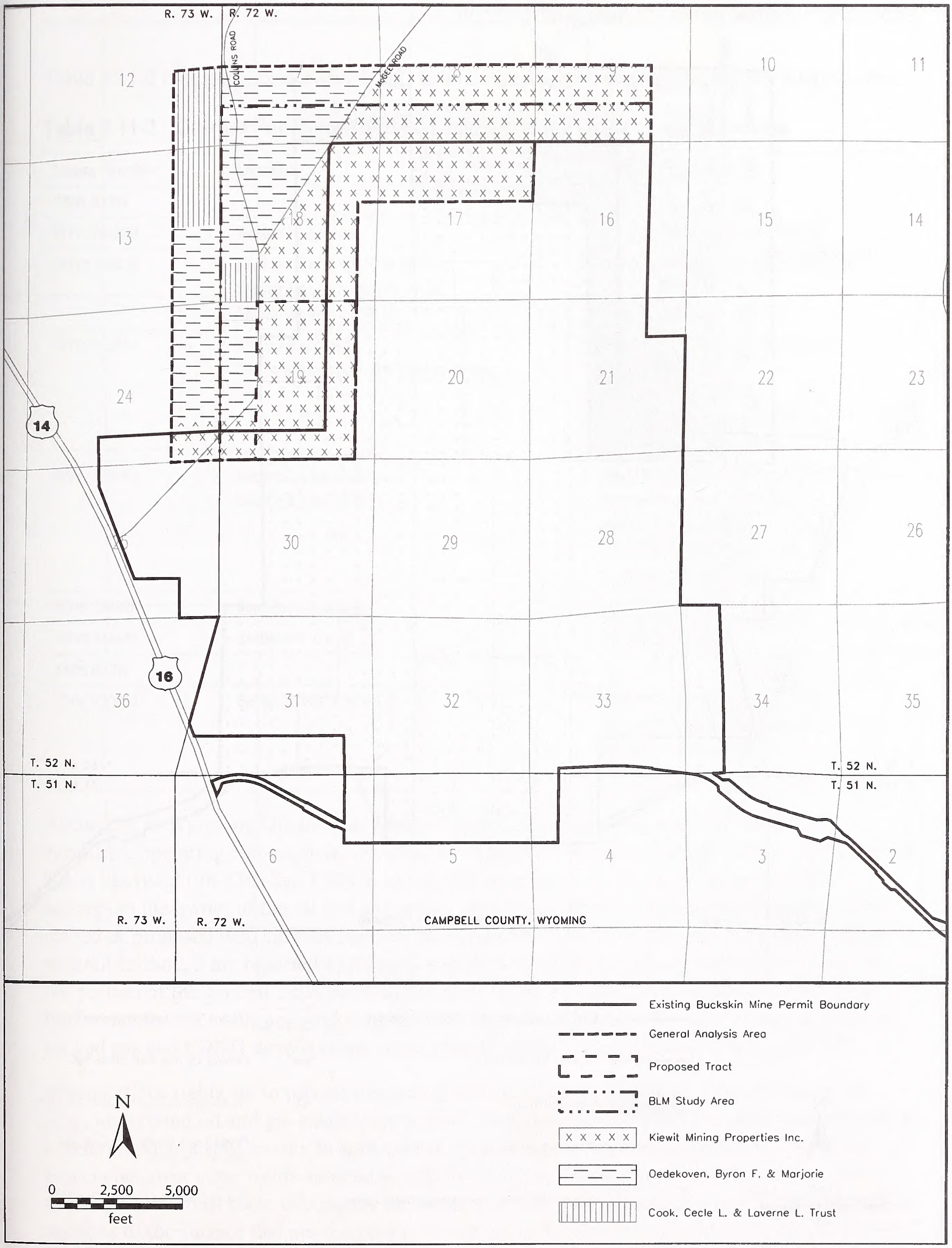
U.S. Highway 14-16 lies approximately 1 mile southwest of the general analysis area; it is accessed from the general analysis area via the Collins Road. The Collins Road forms the western boundary of the proposed tract, crossing vertically through the western part of the general analysis area. At its intersection with the McGee Road, it continues to the north while the McGee Road angles to the northeast. Wyoming Highway 59 is approximately 2 miles east of the general analysis area; no public access connects that highway with the general analysis area. Section 3.15 provides additional details about transportation facilities in the general analysis area.

3.11.1.1 Oil and Gas Production

Oil and gas estates in the general analysis area fall under a mix of federal and private ownership (map 3.11-2). Table 3.11-1 shows the breakdown of ownership in the proposed tract and BLM study area.

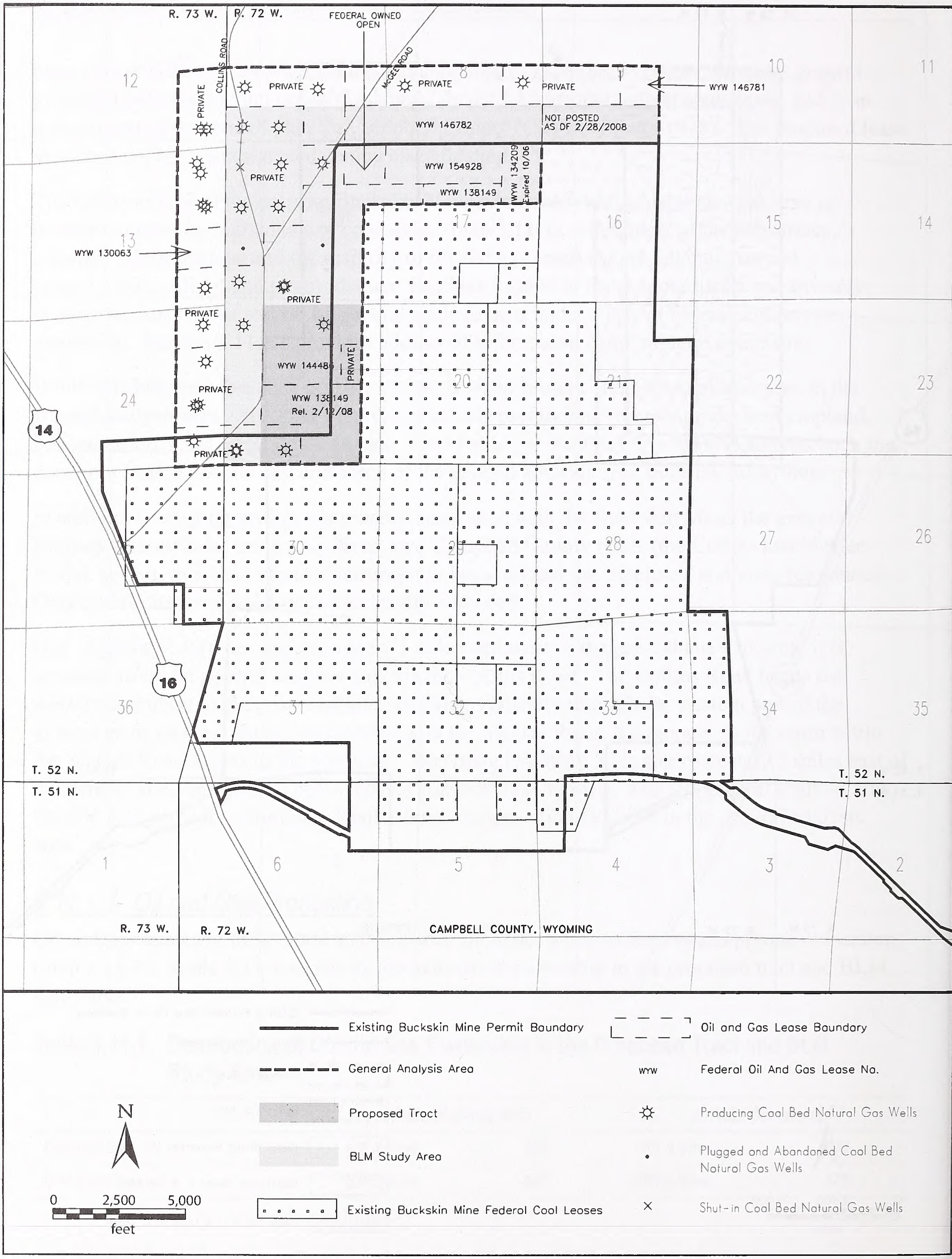
Table 3.11-1. Distribution of Oil and Gas Ownership in the Proposed Tract and BLM Study Area

	Federal Ownership		Private Ownership	
Proposed tract	251.1 acres	60%	167.9 acres	40%
BLM study area	806.5 acres	43%	1,076.5 acres	57%



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.11-1
Surface Ownership in the General Analysis Area



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.11-2

Oil and Gas Ownership, Leases, and Facilities in the General Analysis Area

Table 3.11-2 lists the current (May 2008) federal oil and gas lessees in the general analysis area.

Table 3.11-2. Current Federal Oil and Gas Leases in the General Analysis Area

Lease Number	Location	Lessees of Record
T52N R72W		
WYW 134209	Section 17; Lots 1,9	Expired 10/31/06, closed 3/19/2007
WYW 138419	Section 17; Lots 6,7,10,11,14 Section 19; Lots 11,13–15, 19, 20 Section 20; Lots 3,6,10,11	Relinquished 2/6/2008, closed 2/12/2008
WYW 146781	Section 9; Lots 9,10 And other lands outside of BLM study area	Majestic Petroleum Operations LLC Preston Reynolds & Co., Inc. Redstone Resources Inc. Storm Cat Energy (Powder River) LLC Woodward Enterprises LLC
WYW 146782	Section 7; Lots 13,20 Section 8; Lots 10-16	Majestic Petroleum Operations LLC Preston Reynolds & Co., Inc. Redstone Resources Inc. Storm Cat Energy (Powder River) LLC Woodward Enterprises LLC
WYW 154928	Section 17; Lots 2–4	Van K. Bullock
WYW 144486	Section 19; Lot 10	Terminated 8/8/2008
T52N R73W		
WYW 130063	Section 2; Lots 7,10,12,18	Devon Energy Production Co. L.P. Majestic Petroleum Operations LLC Redstone Resources Inc. Woodward Enterprises LLC

According to Wyoming Oil and Gas Conservation Commission records (May 2008), no permitted, operating conventional oil wells are located in the general analysis area. The Supreme Court has ruled (98-830) that CBNG, previously referred to as coal bed methane or CBM, belongs to the owner of the oil and gas estate. As of May 2008, 30 permits had been issued for drilled or proposed well sites on lands in the BLM study area itself. Of those, 12 have expired without drilling, 3 are reported as plugged and abandoned, and 15 are currently producing. In the portion of the general analysis area outside of the BLM study area (in the 0.25-mile-wide buffer) another 12 wells are producing CBNG. Additional information relative to conventional oil and gas and CBNG development in the general analysis area is included in section 3.3.2.

When surface rights are in private ownership and the rights to develop the mineral resources (e.g., underlying oil and gas estates) are publicly held and managed by the federal government, it is referred to as a split estate. In split estates, mineral rights are considered dominant, taking precedence over other rights associated with the property, including surface ownership. The mineral owner must show due regard for the interests of the surface owner and occupy only those portions of the surface that are reasonably necessary to develop the mineral estate (BLM 2009a).

Under FLPMA, the BLM is mandated to manage public lands under a multiple-use approach, including the federal mineral estate, to enhance the quality of life for all present and future generations. The Mineral Leasing Act of 1920 guides the land use planning, leasing, bonding, operations, and reclamation associated with all development of federal oil and natural gas resources. Various laws granted land patents to private individuals but reserved the mineral rights for the federal government. The BLM must comply with the provisions of the laws under which the surface was patented; however, many of those laws do not identify the rights of the surface owner in split estate mineral development situations (BLM 2009a).

Numerous ancillary facilities exist in support of current oil, gas, and CBNG development in the general analysis area. This supporting infrastructure may include well access roads; well pads; surface or underground production equipment at the wellheads; well production casing that extends from the surface to the production zone; underground gas-gathering lines and high-pressure transmission pipelines; facilities for the treatment, discharge, disposal, containment, or injection of produced water; metering and compressor stations; and electrical overhead or underground power lines to energize pumps and compressors. Because CBNG development and production have been occurring near the Buckskin Mine for many years, some of these facilities, particularly pipelines, lie within the general analysis area (section 3.15).

Section 3.3.2 and section 3.11.1 address producing, abandoned, and shut-in oil and gas (conventional and CBNG) wells in the general analysis area; appendix E (table of permitted oil/gas wells) discusses these features within 3 miles of the general analysis area. Well location information, oil and gas ownership and oil and gas lease information are presented on map 3.11-2 and in table 3.11-2. The BLM manages federal lands on a multiple-use basis, in accordance with federal regulations. In response to conflicts between oil and gas and coal lease holders, BLM policy advocates optimizing the recovery of all minerals to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. In the past, negotiations between some applicant mines and existing oil and gas lessees have resulted in agreements that allowed development of both resources on portions of recently issued LBA tracts. In the PRB, royalties have been and would be lost to both the state and federal governments if federally owned CBNG is not recovered prior to mining, or if federal coal is not recovered due to conflicts between lessees. State and federal governments can lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

3.11.1.2 Coal Mining

South and east of the general analysis area, coal mining is the dominant land use. The mines in this area—Buckskin, Rawhide, Eagle Butte, Dry Fork, and Wyodak—form a contiguous development area from the northernmost mine (Buckskin) to the Wyodak mine located just outside and immediately east of the City of Gillette. This cluster of mines represents the northernmost group of developed coal mines in Campbell County. The permitted coal production rate at the Buckskin Mine is currently 42 million tons; actual production in 2007 was

25.3 million tons, representing an increase of approximately 11% over the 22.8 million tons produced in 2006. The other four coal mines are permitted for a combined total annual production of 86 million tons, and reported a total actual production in 2007 of 52.4 million tons. The Hay Creek II lease application is the only LBA currently pending in this group of mines. Eagle Butte's West LBA (WYW-155132) was the last lease granted to a mine in the group.

3.11.1.3 Recreation

Big game hunting (pronghorn, mule deer, and white-tailed deer) is the principal recreational land use within approximately 3 miles of the general analysis area (recreation analysis area) (section 3.10). Surface land ownership in the PRB is approximately 80% private, and hunting is allowed only with the landowner's permission. The WGFD reports that limited hunter access to private lands has become a primary issue in providing hunting opportunities and controlling optimal harvest levels and distribution (WGFD 2008a). During the past two or three decades, landowners have been increasingly reluctant to allow sportsmen to freely cross and hunt on their lands, thus reducing the amount of private lands that are open and reasonably available for hunting. Access fees are commonly levied and continue to rise. Most of the private land in the recreation analysis area is leased to professional outfitters catering to nonresident hunters.

In general, USDA-FS- or BLM-managed public lands in Wyoming, as well as state-owned school sections, are open to hunting if legal access is available. Due to safety concerns, however, publicly owned surface lands contained in active mining areas are closed to the public. No public lands are included in the recreation analysis area. In addition to access, WGFD (2008) cites that drought, severe winters, and increased incidents of poaching have diminished the hunting opportunities for deer and pronghorn in the recreation analysis area during the past decade.

The WGFD classifies most of the recreation analysis area as yearlong habitat for pronghorn. None of the area is classified as severe winter range, crucial, or critical habitat, and no migration corridors have been identified. The recreation analysis area is in pronghorn hunt area 17, which is within the Gillette pronghorn herd unit. During the 2007 season, harvest from this herd unit (including all animals harvested in hunt areas 17, 18, and 19) included 958 bucks, 533 does, and 0 fawns (a total of 1,481 pronghorn). Post-season population estimated for the same pronghorn herd unit in 2007 numbered 16,823, which is well above the objective (11,000) for the herd (WGFD 2008a).

The WGFD has classified the lands in the recreation analysis area as a mix of yearlong and winter/yearlong range for mule deer. No winter, crucial, or critical mule deer habitat or migration corridors have been identified in this area. The recreation analysis area is located in mule deer hunt area 18, part of the Powder River mule deer herd unit, which also includes hunt areas 17, 23, and 26. During the 2007 season, harvest from this herd unit (in hunt area 18) included 657 bucks, 255 does, and 0 fawns (a total of 912 mule deer out of 1,553 active licenses issued). Total harvest for the Powder River mule deer herd unit included 2,590 bucks, 1,076 does, and 44 fawns (a total of 3,710). The 2007 post-season population estimate was 49,560 with a herd management objective of 52,000. The WGFD believes that, because

outfitters lease much of the private land in this herd unit and hunting antlered bucks is encouraged, the buck/doe ratios are skewed, and additional pressure is placed on any accessible public lands.

The WGFD manages white-tailed deer separately from mule deer. This species is rarely seen in the recreation analysis area because white-tailed deer prefer riparian areas and irrigated agricultural lands (WGFD 2008). The entire area is outside of any white-tailed hunting area authorized by WGFD; therefore, no licenses may be issued or filled.

Rare sightings of elk have been confirmed in recreation analysis area. No elk hunt areas have been assigned in Campbell County. The closest is the Fortification area herd approximately 18 miles southwest of the mine, and another in the Rochelle Hills near the Thunder Basin National Grasslands, approximately 70 miles southeast of the general analysis area.

Upland game birds (e.g., turkeys, grouse) inhabit some parts of the recreation analysis area. Hunting opportunities are limited because of lack of habitat and restricted access to private lands. The turkey hunting seasons are spring and fall, while other upland game birds are hunted only in fall.

No sport fisheries exist in the recreation analysis area.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action

Under the Proposed Action, all existing oil and gas surface and downhole production and transportation equipment and facilities in the proposed tract would be removed, and all oil and gas development in the tract would be stopped during mining and reclamation activities. Oil and gas development in the proposed tract could resume after reclamation is complete and the bond is released (approximately 10 years). Deeper conventional oil and gas could be reestablished, and coal seams deeper than those intended for mining would also be available for CBNG development in the postmine environment.

Existing coal and transportation activities, infrastructure, and facilities would continue to operate in the area. Coal production would be expected to remain at its current average rate of 25 million tons per year for up to two years beyond the current life-of-mine estimate. No major public roadways would be affected; Kiewit does not anticipate relocating the Collins Road to access new coal reserves.

Livestock and wildlife would be incrementally displaced during mining as the active pit moves through the coal reserves, but the proposed tract would provide suitable grazing habitat for both groups after reclamation. Section 3.10 provides a detailed description of impacts on livestock and wildlife.

General access to and across the proposed tract for recreation, ranching, and oil and gas development would be restricted or eliminated during mining and reclamation. Following

reclamation bond release, management of the privately owned surface would revert to the private surface owner.

Mining support activities, described in section 1.1.3.3, would cause temporary surface disturbance in a buffer area north of the proposed tract. These activities would extend access limitations as well as impacts on all infrastructure and premining land uses to the buffer area.

3.11.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.11.2.3 Alternative 2

Under Alternative 2, impacts would be the same as those described under the Proposed Action, but would extend over an area of up to 1,883 acres. This alternative could impact public use of the Collins and McGee roads if one or both were closed or relocated, but Kiewit does not anticipate pursuing either option. Section 3.15 contains additional information regarding impacts on transportation.

Mining support activities, described in section 1.1.3.3, would cause temporary surface disturbance within a 0.25-mile-wide buffer around the final tract configuration. These activities would extend access limitations as well as impacts on all infrastructure and premining land uses to the buffer area.

3.11.3 Regulatory Compliance, Mitigation, and Monitoring

If one of the action alternatives is implemented, mined areas will be reclaimed as specified in the approved mine permit reclamation plan to support the primary postmining land uses of wildlife habitat and livestock grazing. Reclamation of agricultural pastures and croplands may occur, but is highly dependent on the postmine topography and landowner agreements. Mining and reclamation procedures would include stockpiling and replacing topsoil, using reclamation seed mixtures approved by the WDEQ/LQD, and replacing stock reservoirs to assure full use of all grazing and wildlife habitat restored under reclamation.

Steps to control invasive non-native plant species using chemical and mechanical methods would be included in the amended mine plan. Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if corrective action is needed during vegetation establishment. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for anticipated postmining land uses.

See section 3.3.3.3 for discussion of regulatory requirements, mitigation, and monitoring related to oil and gas development.

The reclamation standards required by SMCRA and Wyoming state law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in Wyoming.

3.11.4 Residual Impacts

No residual impacts on land use and recreation are expected.

3.12 Cultural Resources and Native American Consultation

This section describes cultural resources, including Native American resources, in the general analysis area, and identifies impacts on these resources that could result from the Proposed Action and alternatives.

3.12.1 Cultural Resources

3.12.1.1 Affected Environment

Cultural resources represent the nonrenewable remains of past human activity. The PRB, including the general analysis area, has been inhabited by hunting and gathering populations for at least 13,000 years. Throughout prehistory, groups of mobile hunters and gatherers depended on the wide variety of plant and animal resources in the area for their survival.

Chronology

Frison's (1978, 1991) chronology for the Northwestern Plains divides the occupation of the area into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, Protohistoric, and Historic periods.

- Paleoindian period (13,000 to 7,000 years before present [B.P.])
- Early Plains Archaic period (7,000 to 5,000–4,500 years B.P.)
- Middle Plains Archaic period (5,000 to 4,500–3,000 years B.P.)
- Late Plains Archaic period (3,000 to 1,850 years B.P.)
- Late Prehistoric period (1,850 to 400 years B.P.)
- Protohistoric period (400 to 250 years B.P.)
- Historic period (250 to 120 years B.P.)

The Paleoindian period included a number of cultural complexes that were associated with distinctive styles of lanceolate or stemmed projectile points (Frison 1978). On the Northwestern Plains, the Paleoindian period is synonymous with the "big game hunting tradition," in which large mammals such as bison and mammoth were hunted. Evidence for the use of vegetal

resources is present among Paleoindian populations occupying the Black Hills and Big Horn Mountains.

Projectile point styles from the Early Plains Archaic period reflect a change from the large lanceolate and stemmed projectile points characteristic of the Paleoindian Period to large side- or corner-notched types. The subsistence pattern reflects use of a broad spectrum of resources and a much-diminished use of large mammals.

The onset of the Middle Plains Archaic is defined by the appearance of the McKean Techno Complex around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points include the Duncan and Hanna stemmed variants as well as the McKean lanceolate type. These point types continued to be used until 3,100 years B.P. when they were replaced by a variety of corner-notched points (Pelican Lake and Besant) (Martin 1999). Sites dating from this period exhibit a continued emphasis on plant procurement and processing.

The Late Plains Archaic is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed the continued expansion of groups into the interior basin grasslands as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The corner-notched and side-notched dart points characteristic of the Late Archaic are replaced by smaller corner- and side-notched points for use with the bow and arrow. Ceramic technology also appears. Around 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift may reflect a narrower subsistence base focused on the communal hunting of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) was the beginning of Euro American influence on the aboriginal cultures of the Northwestern Plains. Additions to the material culture include the horse and European trade goods such as glass beads, metal, and firearms. Projectile points of this period include side-notched, tri-notched, and un-notched points, with the addition of metal points. Groups occupying the basin at this time appear to have practiced a highly mobile settlement strategy.

The Historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The Oregon Trail brought numerous pioneers through Wyoming, but few stayed. It was not until the cattle industry developed in the late 1860s that what is now Wyoming became attractive for settlement. The region offered abundant grazing lands for raising livestock that could be shipped across the country via the recently completed (1867–1868) transcontinental railroad.

Settlement of the region surrounding Gillette, Wyoming, began in the late 1800s, after the Fort Laramie Treaty in 1876 placed the Sioux on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, with dryland farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 to promote the settlement of undeveloped areas along the rail lines. The presence of the railroad allowed the cattle industry to

further develop because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881).

The dryland farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of the PRB during the years around World War I. Although the principles of dryland farming were sound, success still required a certain amount of precipitation each year. Wyoming encouraged dryland settlement of its semi-arid lands through a Board of Immigration created in 1911. Newspapers extolled the virtues of dryland farming, and railroads conducted well-organized advertising campaigns on a nationwide basis to settle the regions through which they passed.

The most intensive period of homesteading activity in the eastern PRB occurred in the late 1910s and early 1920s. Promotional efforts by the state and the railroads, the prosperous war years for agriculture in 1917 and 1918, and the Stock Raising Act of 1916 with its increased acreage (but lack of mineral rights) all contributed to this boom period. A large number of land filings consisted of existing farms and ranches expanding their holdings in an optimistic economic climate. However, an equally large number of homesteaders had been misled by promotional advertising and were not adequately prepared for the experiences that awaited them in the PRB. It soon became apparent to the would-be dryland farmer that he could not make a living by raising only crops. Some were initially successful in growing wheat, oats, barley, and other small grains, along with hay, alfalfa, sweet clover, and other grasses for the increased number of cattle.

A drought in 1919 was followed by a severe winter, and market prices fell in the spring of 1920. Those homesteaders who were not ruined by the turn of events often became small livestock ranchers and limited their farming to growing forage crops for their livestock and family garden plots. Some were able to obtain cheap land as it was foreclosed or sold for taxes. During the 1920s, the size of homesteads in Wyoming nearly doubled and the number of homesteads decreased, indicating the shift to livestock raising (LeCompte and Anderson 1982).

With serious drought beginning in 1932, Weston, Campbell, and Converse counties were eligible for a drought relief program. The Northeast Wyoming Land Utilization Project began repurchasing the low value homestead lands and making the additional acres of government land available for lease. This helped the small operator expand his grazing land. Cropland taken out of production could be reclaimed and added to the grazing lease program. Grazing associations were formed to regulate grazing permits. In 1934, the Agricultural Adjustment Administration began studying portions of Converse, Campbell, Weston, Niobrara, and Crook counties. In all, 2 million acres were included in the Thunder Basin Project (LA-WY-1). Nationally, the program hoped to shift land use from farms to forest, parks, wildlife refuges, or grazing districts. In marginal agricultural areas, cash crops were replaced by forage crops, the kind and intensity of grazing was changed, and the size of operating units was expanded (USDA Forest Service n.d.).

During the development program to rehabilitate the range, impounding dams were erected, wells were repaired, springs developed, and homestead fences were obliterated while division fences

were constructed for the new community pastures. Farmsteads were destroyed and the range reseeded. Remaining homesteaders and ranchers often purchased or scavenged materials from the repurchased farmsteads. Pits were dug on some homesteads and machinery and demolished buildings buried (many of these were dug up during the World War II scrap drives). Ironically, the rehabilitation project used a labor pool of former farmers who had spent years building what the government paid them to destroy. Their efforts were so successful that almost no trace remains of many homesteads.

While counties lost much of their population base as a result of the Resettlement Administration relocation program, they were strengthened financially through school closings, limiting road maintenance to main arterioles, and receipt of delinquent taxes payments. The remaining subsidized ranches were significantly larger and provided a stabilizing effect on the local economies. Three grazing associations were formed: the Thunder Basin Grazing Association, the Spring Creek Association, and the Inyan Kara Grazing Association. These associations provided more responsible management of the common rangeland than in earlier years.

Early fur trappers noted the presence of coal in Wyoming in the mid 1800s and in northeastern Wyoming as early as the 1830s. The oldest coal mines in Wyoming were established along the Union Pacific Railroad; however, transportation systems were not developed in northeastern Wyoming until after the Fort Laramie Treaty in 1876. In the vicinity of Gillette, local ranchers and settlers unofficially mined coal in the area for their own use. Similar to the history described for the cattle industry and ranching, once the railroad arrived commercial development of coal mining began. Steam locomotives were the major consumer of coal in northeastern Wyoming, and coal production accelerated during World War II. Annual coal production declined after the war when the railroads transitioned from steam- to diesel-powered locomotives. In 1965, the demand for low-sulfur coal increased for use in power plants, and coal leasing began at an intensive level (Rosenberg 1990).

Class I and Class III Cultural Resources Surveys

A Class I files search is conducted through the Wyoming State Historic Preservation Office (SHPO) prior to beginning field surveys for new projects to determine if the area has been previously searched and to identify any known resources in the area. The files are accessible only to qualified archaeologists with appropriate clearance from the agency.

A Class III cultural resources survey is an intensive and comprehensive pedestrian inventory of a proposed project area conducted by professional archaeologists and consultants. The survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. These cultural properties are then evaluated for eligibility for inclusion in the National Register of Historic Places (NRHP). The properties must be recorded at a sufficient level to allow for this evaluation. Determinations of eligibility are made by the managing federal agency in consultation with the SHPO. If a property is determined to be not eligible for inclusion in the NRHP, no further work is required and the property can be disturbed without any further analysis or mitigation. Consultation with the SHPO must be completed before the mining plan can be approved.

Eighteen cultural resource surveys have been conducted in the vicinity of the general analysis area. Eleven of those surveys were associated with expansion of the Buckskin Mine and seven were conducted for other activities as follows: one pipeline project, one power line project, one seismic line project, two CBNG developments, and two conventional oil well developments. In November 2007, a Class III cultural resource survey was conducted in the portion of the general analysis area that had not been previously surveyed: Sections 7, 9, 18, and 19 of T52N R72W and Sections 12, 13, and 24 of T52N R73W. The 2007 survey was conducted over an area of approximately 920 acres (Newberry 2008).

A total of 19 cultural sites have been documented in the vicinity of the Buckskin Mine. Of these, 14 are located in the general analysis area (table 3.12-1). One isolated find was recorded and one previously recorded site, 48CA1832, could not be located during the 2007 survey.

Table 3.12-1. Cultural Sites Previously Identified in the General Analysis Area

Site Number	NRHP Status	Author(s)/Organization	Report/Study Name	Year	Site Type
48CA862	NE	University of Wyoming	Buckskin Mine	1980	P
48CA865	NE	University of Wyoming	Buckskin Mine	1980	P
48CA868	NE	University of Wyoming	Buckskin Mine	1980	P
48CA1828	NE	High Plains Consultants	Spring Draw Survey	1982	P
48CA1830	NE	High Plains Consultants	Spring Draw Survey	1982	H
48CA1832	NE	High Plains Consultants	Spring Draw Survey	1982	H
48CA1834	NE	High Plains Consultants	Spring Draw Survey	1982	H
48CA2223	NE	LTA Incorporated	Exxon Carbon Dioxide Pipeline Project Segment 2	1985	P
48CA3376	NE	TRC/Mariah Associates	Class III Inventory of the Hay Creek Tract Buckskin Mine	2000	H
48CA3898	NE	TRC/Mariah Associates	Triton Coal Company LLC Buckskin Mine Lease Expansion	2001	P
48CA6360	NE	Ecosystems Management	Buckskin Mining Company Hay Creek II	2006	H
48CA6361	NE	Ecosystems Management	Buckskin Mining Company Hay Creek II	2006	H
48CA6362	NE	Ecosystem Management	Buckskin Mining Company Hay Creek II	2006	H
48CA6797	NE	Antiquus Cultural Resource Consulting	Hay Creek II LBA	2007	H

NRHP = National Register of Historic Places; NE = Not eligible for the National Register of Historic Places
Site types: P = prehistoric; H = historic
Source: Newberry 2008

The entire general analysis area has been inventoried for cultural resources at a Class III level. Of the 14 sites identified in that area, 6 are prehistoric and 8 are historic (Newberry 2008). All of the prehistoric sites are determined not eligible for the NRHP. No further protection is afforded these sites and no further work is required. Historic site categories documented in the general analysis area fall under the context of rural settlement. Specifically, the historic sites in

the general analysis area are associated with homesteading and stock-raising circa the 1910s to the 1940s. All of the historic sites are determined not eligible for listing on the NRHP. No further protection is afforded these sites and no further work is required.

3.12.1.2 Environmental Consequences

Proposed Action

Under the Proposed Action, up to 6 prehistoric and 8 historic sites would be removed as a result of mining. All of these sites were determined to be not eligible for inclusion in the NHRP. Therefore, the Proposed Action would have no impacts on known cultural resources.

Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Currently approved surface disturbances associated with mining operations would continue in the overlap between the general analysis area and the existing Buckskin Mine permit area. Ongoing activities will have no impact on NRHP cultural resources. As discussed in section 2.2.2, a decision to reject the lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, up to 6 prehistoric and 8 historic sites would be removed as a result of mining. All of these sites were determined to be not eligible for inclusion in the NHRP. Therefore, Alternative 2 would have no impacts on known cultural resources.

3.12.1.3 Regulatory Compliance, Mitigation, and Monitoring

Class I and Class III surveys are conducted prior to disturbance to identify cultural resources on all lands affected by federal undertakings, including leasing of federal minerals. All cultural sites documented in the general analysis area during surveys associated with this EIS were determined to be not eligible for listing on the NRHP. Therefore, these sites are afforded no further protection and no further work is required before mining can begin.

Mining activities are monitored during topsoil stripping and other surface-disturbing activities. If previously unknown cultural resources are discovered during these operations, Buckskin will stop all activity in that vicinity until a qualified archaeologist can evaluate the find. If the archeologist determines it is warranted, SHPO is consulted to further evaluate the eligibility of the discovery for inclusion on the NRHP. Cultural resources that are determined to be eligible for the NRHP would be avoided or, if avoidance is not possible, a recovery plan would be implemented prior to disturbance and data would be collected (recorded or excavated) from the site(s) prior to removal. If a lease is issued under either of the action alternatives, the BLM would attach a stipulation requiring the lessee to notify appropriate state and federal personnel if cultural materials are uncovered during mining operations. This stipulation is included in appendix D. Full consultation with SHPO must be completed prior to approval of a mining plan.

3.12.1.4 Residual Impacts

No cultural resources eligible for listing on the NRHP have been formally identified and recorded in the general analysis area to date. If either of the action alternatives is implemented, sites determined to be ineligible for the NRHP would be permanently removed as a result mining. If cultural resources are discovered in the future that are determined to be eligible for the NRHP and cannot be avoided, they would be permanently removed as a result of mining.

Although cultural resources that are not removed or that remain undiscovered prior to disturbance would be permanently destroyed by surface coal mining operations, the analyses (e.g., intensive pedestrian inventories, site evaluations and excavation, and analysis of prehistoric cultural resources) required prior to implementation of these activities provide substantial information and a better understanding regarding existing resources and local prehistory in the region.

3.12.2 Native American Consultation

3.12.2.1 Affected Environment

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but possessing no human-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded in the general analysis area to date. However, the geographic position of the general analysis area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devil's Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups.

3.12.2.2 Environmental Consequences

No Native American heritage, special interest, or sacred sites have been formally identified and recorded in the general analysis area to date. Therefore, the Proposed Action and alternatives would have no impact on known sites.

3.12.2.3 Regulatory Compliance, Mitigation, and Monitoring

The following tribes have been identified as groups with potential concerns about actions in the PRB: Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Sioux, Rosebud Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, Cheyenne River Sioux, Apache Tribe of Oklahoma, Comanche Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. Copies of the EIS have been sent to these tribal governments and representatives. They are also being provided with more specific information about the known cultural sites in the general analysis area. Their

help is being requested in identifying potentially significant Native American heritage, special interest, or sacred religious or cultural sites in the general analysis area before a leasing decision is made on the Hay Creek II application.

Native American tribes were consulted at a general level in 1995–1996 as part of an update to the BLM Buffalo Resource Area RMP. Some of the Sioux tribes were consulted by the BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota, in March 2002.

If Native American heritage, special interest, or sacred sites are discovered in the future in the general analysis area, Buckskin will stop all activity in that vicinity until all appropriate entities have been notified and all steps have been taken to address concerns related to those sites.

3.12.2.4 Residual Impacts

Although cultural resources that are not removed or have remain undiscovered prior to disturbance would be permanently destroyed by surface coal mining operations, the analyses (e.g., intensive pedestrian inventories, site evaluations and excavation, and analysis of prehistoric cultural resources) required prior to implementation of these activities provide substantial information and a better understanding regarding existing resources and the local prehistory in the region.

3.13 Visual Resources

This section describes existing visual resources in the general analysis area and identifies impacts that would result from the Proposed Action and alternatives.

3.13.1 Affected Environment

Visual sensitivity levels are determined by the concern of viewers for what they see and the frequency of travel through an area.

Natural views within and into the general analysis area consist mainly of vegetated open landscapes, including rolling mixed-grass prairie, scattered stands of sagebrush, and a small region of rough breaks. Natural views from the general analysis area to the north and west are similar to those within the area. Views to the south and east consist mostly of surface mining activities and facilities. Signs of human use in and near the area include active farming and ranching activities (fences, homesteads, hayfields, croplands, farm equipment, and livestock), tree shelterbelts around residences, CBNG development (pipeline rights-of-way, well shelters, and compressor stations), transportation facilities (roads and railroads), and overhead electric power lines and substations. U.S. Highway 14-16 lies approximately 1 mile to the southwest of the general analysis area. The southern portion of the general analysis area can be viewed from this roadway with the Buckskin Mine storage silos beyond it. The Collins and McGee roads pass through the western half of the general analysis area, and active mining at Buckskin is visible from both roads.

For management purposes, the BLM evaluated the visual resources on lands under its jurisdiction in the 1985 Buffalo RMP (BLM 1985). The inventoried lands were classified into visual resource management (VRM) classes used to describe increasing levels of change within the characteristic landscape. They are defined as follows (BLM 2001a):

- Class I—Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.
- Class II—Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.
- Class III—Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.
- Class IV—Activity attracts attention and is a dominant feature of the landscape in terms of scale.
- Class V—The natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

The 2001 RMP Update (BLM 2001a) covers Campbell County and the general analysis. The general analysis area is classified as VRM class IV because of the industrial nature of the energy development and active farming and residential use in the area. The overall natural scenic quality of class IV area is considered relatively low.

Surface coal mines are not considered to be major emitting facilities in accordance with the WDEQ/AQD Rules and Regulations (Chapter 6, Section 4). Therefore, State of Wyoming does not require mines to evaluate their impacts on class I areas, though the BLM does consider such issues during leasing.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action

Under the Proposed Action, mining operations in the proposed tract (419 acres) would be within 1 mile of and visible from U.S. Highway 14-16; mine support activities such as topsoil stripping and stockpiling (described in section 1.1.3.3) could be 0.25 mile closer to the highway. Mining activities would encroach to within 100 feet of the eastern right-of-way of the Collins Road (section 3.15). The road would remain in its existing alignment, but mined areas immediately east of the right-of-way would be lowered during and after mining operations. The areas disturbed under the Proposed Action would be considered VRM class V prior to reclamation. Reclamation would restore these areas to at least the premining VRM class IV conditions. The reclaimed land would resemble the surrounding undisturbed terrain, although slopes might appear smoother (less intricately dissected) and the vegetation would be more homogenous for several years. No visual resources that are unique to this area have been identified in or near the proposed tract.

3.13.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future. Mining operations would continue on existing Buckskin Mine leases and the current VRM class designations for the mine would not change.

3.13.2.3 Alternative 2

Under Alternative 2, mining in up to 1,883 additional acres of the BLM study area would be within 0.5 mile of and visible from U.S. Highway 14-16; mine support activities such as topsoil stripping and stockpiling (described in section 1.1.3.3) could be 0.25 mile closer to the highway. Mining activities would encroach to within 100 feet of the eastern rights-of-way for both the Collins and McGee roads (section 3.15). The roads would remain in their existing alignments, but adjacent mined areas would be lowered during and after mining operations. Mining could only occur between and west of these two roads if they were closed or relocated, as described in section 2.2.1.1 and section 2.2.3.1. Kiewit does not anticipate pursuing either of those options, and neither road is expected to be disturbed under this alternative. After mining and prior to reclamation, areas disturbed under Alternative 2 would be considered VRM class V; after reclamation they would be restored to at least their premining VRM class IV condition. The reclaimed area would resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified in or near the general analysis area.

3.13.3 Regulatory Compliance, Mitigation, and Monitoring

Landscape character would be restored during reclamation to resemble the original contours. Disturbed areas would be reseeded with an approved seed mixture that includes native species.

Section 3.2 and section 3.9 provide more detailed discussions of the regulatory requirements, mitigation, and monitoring for topography and vegetation, respectively.

3.13.4 Residual Impacts

No residual impacts on visual resources are expected.

3.14 Noise

This section describes existing conditions in the general analysis area associated with noise, and identifies impacts that would occur under the Proposed Action and alternatives.

3.14.1 Affected Environment

The affected environment is described for noise in the general analysis area and vicinity.

3.14.1.1 Noise Terminology

A decibel (dB) is the unit of measure used to represent sound pressure levels. The A-weighted decibel (dBA) is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise, because the human ear does not perceive lower frequencies in the same manner as higher frequencies. Figure 3.14-1 presents noise levels associated with some commonly heard sounds. Short-term noise, lasting from several seconds to several hours, is quantified by the equivalent noise level (L_{eq}). The 24-hour average noise levels are quantified as "day-night" noise levels.

3.14.1.2 Noise-Sensitive Areas

For the purposes of this noise analysis, noise-sensitive areas have been categorized into the following groups. Map 3.4-4A and shows the occupied residences in and near the general analysis area discussed in this section; map 3.4-4B zooms in on the residence to the west and southwest of the general analysis area.

Occupied Residences within the General Analysis Area

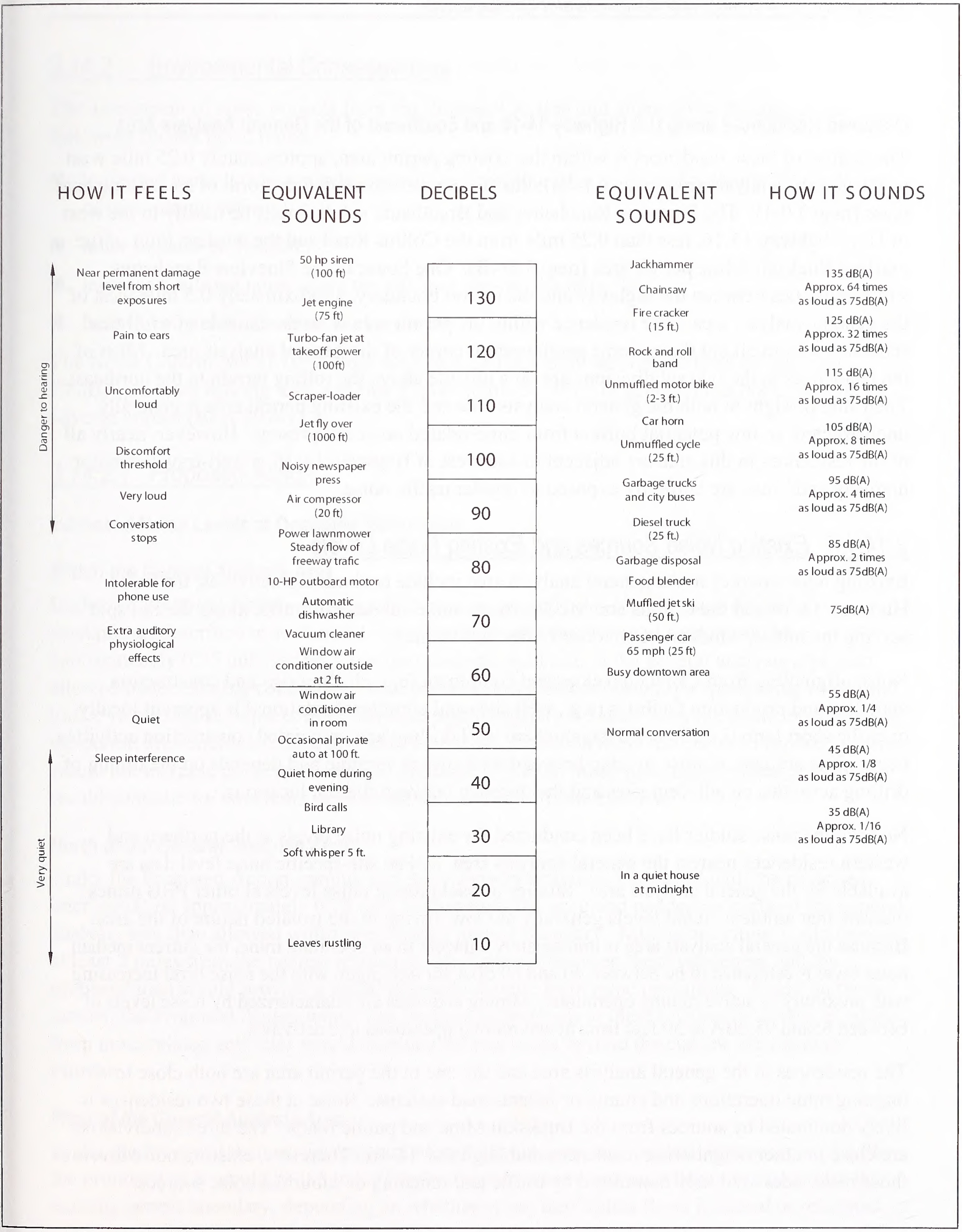
One occupied residence is located within the general analysis area, less than 0.25 mile north of the existing mine permit area (map 3.4-4A). This residence is in direct line-of-sight of the current mine pit and associated support activities (e.g., topsoil stripping, soil stockpiling). The lack of obstacles between the residence and mine operations results in no buffering of noise generated at the mine.

Occupied Residences North of the General Analysis Area

These four residences range from 1.5 to 2.5 miles north of the general analysis area, and at least 2 miles north of the existing mine permit boundary (map 3.4-4A). The high rolling terrain between these residences and the general analysis area blocks their line-of-sight and creates a buffer from noise generated by current mine operations.

Occupied Residences along U.S. Highway 14-16 and West of the General Analysis Area

The nearest of these residences is approximately 0.5 mile west of the general analysis area (map 3.4-4B) and approximately 1.5 miles from overlap between the general analysis area and the Buckskin Mine permit area (map 3.4-4A). The small Green Valley Estates subdivision is immediately west of Highway 14-16, approximately 0.75 mile from the general analysis area and 1.75 miles from the majority of its overlap with the permit boundary. The high rolling terrain between these residences and the general analysis area provides a visual and audio buffer from current and future mine operations.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 3.14-1

Relationship Between A-Weighted Decibel Readings and Sounds of Daily Life

Occupied Residences along U.S Highway 14-16 and Southwest of the General Analysis Area

The nearest of these residences is within the existing permit area, approximately 0.25 mile west of the general analysis area (map 3.4-4B); this residence is immediately north of an existing coal lease (map 3.0-1). The Pineview Ranchettes and Bredthauer subdivisions lie mostly to the west of U.S. Highway 14-16, less than 0.25 mile from the Collins Road and the western limit of the existing Buckskin Mine permit area (map 3.4-4B). One house in the Pineview Ranchettes subdivision lies between the highway and the permit boundary, approximately 0.5 mile west of the general analysis area. The residence within the permit area is on the far side of a hill that separates it from all but the extreme southwestern corner of the general analysis area. Most of the residences in the two subdivisions are on a hillside above the rolling terrain to the northeast. Their line-of-sight to both the general analysis area and the existing permit area is generally unobstructed, so few potential buffers from mine-related noise are present. However, nearly all of the residences in this area are adjacent to and west of Highway 14-16, a well-traveled major highway and, thus, are currently exposed to regular traffic noise.

3.14.1.3 Existing Noise Sources and Existing Noise Levels

Existing noise sources in the general analysis area include coal mining activities, traffic on Highway 14-16 and the Collins and McGee roads, mine-related rail traffic along the rail spur serving the mines, wind, and CBNG activities and facilities.

Noise originating from CBNG development equipment (e.g., drilling rigs and construction vehicles) and production facilities (e.g., well sites and compressor stations) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities occur. The amount of noise overlap between well sites is variable and depends on the timing of drilling activities on adjacent sites and the distance between the site locations.

No baseline noise studies have been conducted for existing noise levels at the northern and western residences nearest the general analysis area, and no site-specific noise level data are available for the general analysis area. Studies of background noise levels at other PRB mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. Because the general analysis area is immediately adjacent to an operating mine, the current median noise level is estimated to be between 40 and 60 dBA for day-night, with the noise level increasing with proximity to active mining operations. Mining activities are characterized by noise levels of between 85and 95 dBA at 50 feet from actual mining operations and activities.

The residences in the general analysis area and the one in the permit area are both close to ongoing mine operations and county or federal road systems. Noise at these two residences is likely dominated by sources from the Buckskin Mine and public roads. The three subdivisions are close to other neighboring residences and Highway 14-16. Therefore, existing noise levels at those residences are likely dominated by traffic and ranching or suburban noise sources.

3.14.2 Environmental Consequences

The assessment of noise impacts from the Proposed Action and alternatives focuses on the following related noise issues:

- increased noise levels at residences with a direct line-of-sight to and within 0.25 to 0.5 mile of new mining activity;
- noise impacts on wildlife;
- increased railroad noise along the rail spur serving the mine; and
- hearing protection for mine workers.

The Noise Control Act of 1972 indicates that a 24-hour equivalent noise level of less than 70 dBA prevents hearing loss, and that a level below 55 dBA, in general does not constitute an adverse impact (EPA 1974).

3.14.2.1 Proposed Action

Increased Noise Levels at Occupied Residences

Within the General Analysis Area

Under the Proposed Action, mining and mine support activities (e.g., topsoil stripping, stockpiling) described in section 1.1.3.3 associated with the proposed tract would be approximately 0.75 mile farther from the occupied residence in the general analysis area than allowed under existing conditions. That occupied residence is currently experiencing mine- and traffic-related noise impacts from activities approximately 0.5 mile from the home; operations in the permit area could encroach to within 0.25 mile. Based on these factors, the Proposed Action would not increase noise levels at this residence; however, noise from mine-related activities would continue for two years beyond the current life-of-mine estimate.

North of the General Analysis Area

Under the Proposed Action, mining and mine support activities associated with the proposed tract would be approximately 0.75 mile farther from the occupied residences north of the general analysis area than allowed within the existing permit boundary. Mining activities would remain at least 2 miles from the nearest residence. High terrain between these residences and the proposed tract would provide a visual and audio barrier from mine operations. Based on these factors, the Proposed Action would not increase noise levels at these residences; however, noise from mine-related activities would continue for two years beyond the current life-of-mine estimate.

West of the General Analysis Area

Under the Proposed Action, the majority of mining and mine support activities associated with the proposed tract would be 0.5 to 0.75 mile closer to these residences than allowed within the existing permit boundary, depending on whether or not the Collins Road is closed or relocated.

Under either scenario, mining activities would remain at least 0.75 mile from the nearest residence and farther away from the nearest subdivision in this area than allowed under existing conditions. High terrain and an active highway located between the residences and the proposed tract provide visual and audio buffers from current and future mine-related noise. Therefore, the Proposed Action would not cause a significant increase in noise levels at these residences; however, noise from mine-related activities would continue for two years beyond the current life-of-mine estimate.

Southwest of the General Analysis Area

Under the Proposed Action, mining and mine support activities associated with the proposed tract would be at least 0.75 mile farther from the majority of occupied residences than allowed within the existing permit boundary. Mining activities associated with the proposed tract would remain at least 0.5 mile from the nearest residence; that residence is within the permit area and immediately adjacent to an existing lease. Few potential buffers from mine-related noise are present between the majority of residences in this area and current or future mine operations. However, nearly all of the residences in this area are adjacent to and west of a well-traveled major highway and, thus, are currently exposed to regular traffic noise. Based on this factor, the Proposed Action would not cause a significant increase in noise levels at these residences; however, noise from mine-related activities would continue for two years beyond the current life-of-mine estimate.

Noise Impacts on Wildlife

Under the Proposed Action, wildlife in the immediate vicinity of the proposed tract would be exposed to noise from mine-related activities for an additional two years, but noise levels are not expected to increase during that period. Anecdotal observations at surface coal mines in the area indicate that wildlife may adapt to increased noise associated with coal mining activity. After mining and reclamation are completed, noise levels would return to premining levels.

Increase in Noise Levels near the Rail Spur

Under the Proposed Action, the proposed tract would be mined as an extension of existing operations. Annual coal production would not increase, but it would be extended by two years beyond the current life-of-mine estimate. No new railroads or rail loading facilities would be constructed under this alternative; rail car loading would continue at the loadout facility in the existing permit area approximately 1.5 miles southeast of the proposed tract. The nearest occupied residence is approximately 2.25 miles to the northwest, with numerous hills and existing noise sources between the rail spur and the residence. Based on these factors, the Proposed Action would not cause a significant increase in levels near the rail spur.

The mines north of Interstate 90 (including Buckskin) share a common rail spur connecting to the main east-west rail line along the interstate to ship coal to users throughout the U.S. No residences are located near the common rail spur north of the railroad junction. Under the Proposed Action, average coal car loading would remain at the same level as under existing conditions for Buckskin Mine (five trains per day). Railroad noise impacts are usually evaluated

by considering the 24-hour average noise increase compared to existing conditions, rather than evaluating short-term L_{eq} noise impacts from each individual train (Federal Transit Administration 2006). Because the average number of coal trains would not increase, the Proposed Action would not cause an increase in the 24-hour average noise levels along the rail spur.

3.14.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. As discussed under the Proposed Action, previously leased coal reserves and permitted mine operations would be closer to most occupied residences west and southwest of the mine than under either action alternative. Mine operations would remain at least 2 miles from residences to the north of the permit boundary. The nearest residence to the existing permit area would remain less than 0.25 mile north of that boundary. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.14.2.3 Alternative 2

Within the General Analysis Area

Under Alternative 2, mining and mine support activities (e.g., topsoil stripping, stockpiling) described in section 1.1.3.3 could eclipse the single occupied residence within the BLM study area (map 3.4-4A) if the McGee road is closed or relocated, as described in section 2.2.3.1. However, Kiewit does not anticipate pursuing road closure or relocation. Therefore, under Alternative 2, mine-related noise sources would remain several hundred feet from the residence, exposing the residence to greater noise levels when mining is closest and continued noise sources for up to six years beyond the current life-of-mine estimate.

North of the General Analysis Area

Under Alternative 2, mining and mine support activities associated with the BLM study area could extend up to 0.5 mile closer to the occupied residences north of the general analysis area than allowed within the existing permit boundary (map 3.4-4A). Mining activities would remain at least 1.5 miles from the nearest residence. High terrain between these residences and the general analysis area would provide a visual and audio barrier from mine operations. Based on this factor, Alternative 2 would not increase noise levels at these residences; however, noise from mine-related activities would continue for up to six years beyond the current life-of-mine estimate.

West of the General Analysis Area

Under Alternative 2, the majority of mining and mine support activities associated with the BLM study area would be 0.5 to 1 mile closer to these residences than allowed within the existing permit boundary, depending on whether or not the Collins and McGee roads are closed or relocated, as described in section 2.2.1.1 and section 2.2.3.1. Regardless of whether one or both roads is affected, mining activities would remain at least 0.5 mile from the nearest residence and farther away from the nearest subdivision in this area than allowed under existing conditions (map 3.4-4B). High terrain and an active highway located between the residences and the proposed tract provide visual and audio buffers from current and future mine-related noise. Therefore, the Proposed Action would not cause a significant increase in noise levels at these residences; however, noise from mine-related activities would continue for two years beyond the current life-of-mine estimate.

Southwest of the General Analysis Area

Under Alternative 2, mining and mine support activities associated with the BLM study area would be approximately 0.5 mile farther from the majority of occupied residences than allowed within the existing permit boundary. Mining activities associated with the BLM study area would remain at least 0.25 mile from the nearest residence (map 3.4-4B); that residence is within the permit area and immediately adjacent to an existing lease. Few potential buffers from mine-related noise are present between the majority of residences in this area and current or future mine operations. However, nearly all of the residences in this area are adjacent to and west of a well-traveled major highway and, thus, are currently exposed to regular traffic noise. Based on this factor, Alternative 2 would not cause a significant increase in noise levels at these residences; however, noise from mine-related activities would continue for up to six years beyond the current life-of-mine estimate.

3.14.3 Regulatory Compliance, Mitigation, and Monitoring

Mine operators are required to comply with Mine Safety and Health Administration regulations concerning noise, which include protecting employees from hearing loss associated with noise levels at the mines. This agency periodically conducts mine inspections to ensure compliance with the requirements of the Federal Mine Safety and Health Act of 1977.

3.14.4 Residual Impacts

No residual noise impacts are expected.

3.15 Transportation

This section describes the affected environment as it relates to transportation in the general analysis area, and identifies impacts that would result from the Proposed Action and alternatives.

3.15.1 Affected Environment

Transportation facilities near the general analysis area include Highway 14-16; Wyoming State Highway 59 (Wyoming 59); the Collins and McGee roads; unimproved local and access roads; the improved Buckskin Mine access road; the Buckskin Mine rail spur; oil and gas pipelines; electric corridors; and associated rights-of-way (map 3.15-1 and map 3.4-4A). Oil and gas pipelines are shown on map 3.15-2.

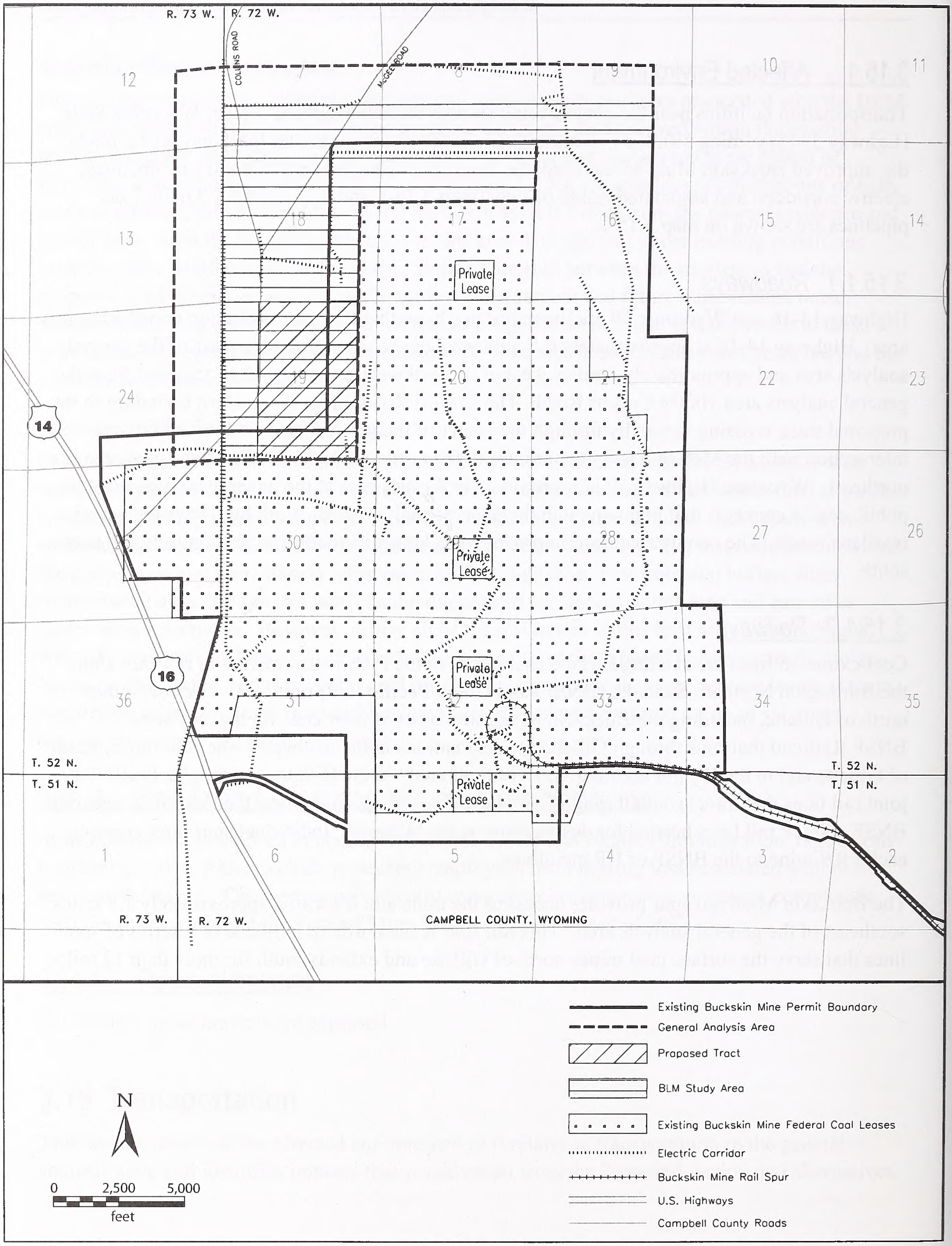
3.15.1.1 Roadways

Highway 14-16 and Wyoming 59 are the major north-south public transportation corridors in this area. Highway 14-16 is approximately 0.5 mile west of the southwestern corner of the general analysis area and approximately 2 miles west of its northwestern corner. It is accessed from the general analysis area via the Collins Road. The Collins Road forms the western boundary of the proposed tract, crossing vertically through the center of the general analysis area. At its intersection with the McGee Road, it continues to the north while the McGee Road angles to the northeast. Wyoming Highway 59 is approximately 2 miles east of the general analysis area; no public access connects that highway with the general analysis area. Both highways are paved, two-lane roads. The county roads are improved, two-lane, dirt roads that also run roughly north-south.

3.15.1.2 Railways

Coal extracted from the existing surface coal mines in the PRB is transported in rail cars along the Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) rail lines. The coal mines north of Gillette, including the Buckskin Mine, ship most of their coal via the east-west BNSF Railroad that runs through Gillette for destinations in the Midwest. The coal mines south of Gillette and in the Wright area ship most of their coal via the Gillette-to-Douglas BNSF/UP joint rail lines that travel south through Campbell and Converse counties, then east over separate BNSF and UP rail lines headed for destinations in the Midwest. Individual spur lines connect each PRB mine to the BNSF or UP mainlines.

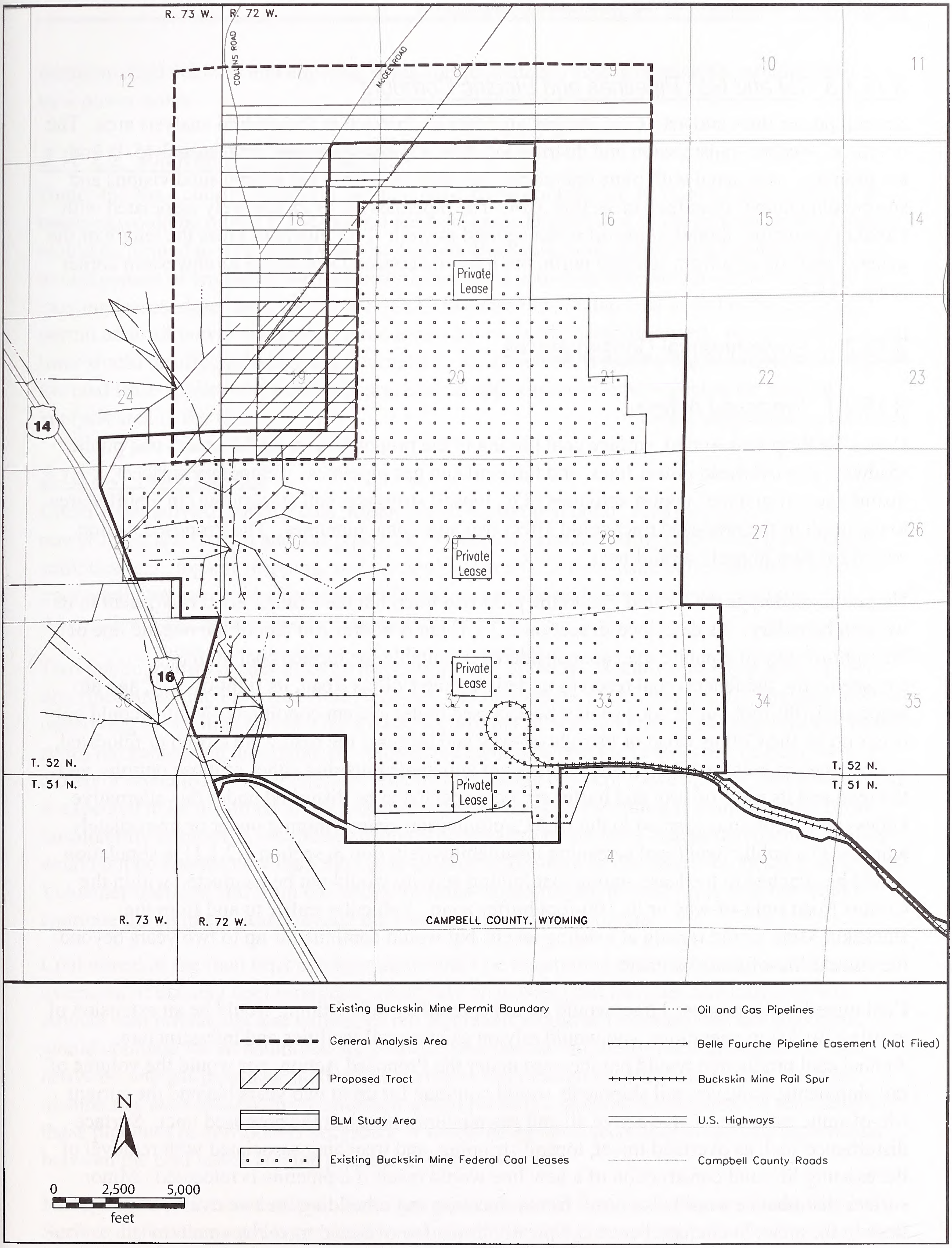
The Buckskin Mine rail spur provides access to the mine and is located approximately 1.5 miles southeast of the general analysis area. This rail spur is the northern terminus of a series of spur lines that serve the surface coal mines north of Gillette and extends south for more than 13 miles.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.15-1

Transportation Facilities in the Vicinity of the General Analysis Area



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 3.15-2

Oil and Gas Pipelines in the General Analysis Area

3.15.1.3 Oil and Gas Pipelines and Electric Corridors

Several power lines and active oil and gas pipelines are present in the general analysis area. The overhead, electric transmission and distribution lines traverse the entire area (map 3.15-1) and are primarily associated with mine operations, but they also serve the nearby subdivisions and surrounding homes described in section 3.14. The pipelines are predominately associated with CBNG production, though some oil is transported as well. Two pipelines cross the length of the general analysis area from south to north, but most are concentrated in the southwestern corner (map 3.15-2).

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract could impact one public roadway, two overhead power lines, and three oil and gas pipelines. Temporary surface disturbance from mine support activities (e.g., topsoil stripping, soil stockpiling) in a buffer area to the north of the proposed tract could affect two additional pipelines. The Proposed Action would have no impact on rail lines.

No public roadways are located within the proposed tract, but the Collins Road is adjacent to its western boundary. As described in section 2.2.1.1, lands within 100 feet of the outside line of the right-of-way of a public road are considered unsuitable for surface coal mining. Consequently, the federal coal reserves underlying the Collins Road, its right-of-way, and an associated 100-foot buffer zone cannot be accessed under current conditions. Mining could only occur under the Collins Road or its right-of-way and buffer if the road were closed or relocated, as described in section 2.2.1.1. Kiewit does not anticipate pursuing either of those options, and the road and its right-of-way and buffer are not expected to be disturbed under this alternative. Unless an exception is granted to the BLM's prohibition against mining under or immediately adjacent to a public road (coal screening unsuitability criterion 3, section 2.2.1.1), a stipulation would be attached to the lease stating that mining activity would not be conducted within the Collins Road right-of-way or its 100-foot buffer zone. Vehicular traffic to and from the Buckskin Mine would remain at existing levels, but would continue for up to two years beyond the current life-of-mine estimate.

Coal mined in the proposed tract would be transported by rail. Mining would be an extension of existing Buckskin operations, and would rely on existing rail facilities and infrastructure. Annual coal production would not increase under the Proposed Action, nor would the volume of rail shipments; however, rail shipments would continue for up to two years beyond the current life-of-mine estimate. Three active oil and gas pipelines intersect the proposed tract. Surface disturbance such as overland travel, topsoil stripping, and trenching associated with removal of the existing line and construction of a new line would result if a pipeline is relocated. Minor surface disturbance would also result from relocating and rebuilding the two overhead power lines in the area. Such disturbance is typically limited to overland travel by small- to

medium-sized vehicles and augering holes approximately 3 feet in diameter to accommodate the new power poles.

3.15.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities necessary to support mining on existing leases, described in section 1.1.3.3. Because the overlap area is within the existing permit area, all power line and pipeline issues have already been addressed. No new roads or rail lines would be affected under this alternative. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.15.2.3 Alternative 2

Under Alternative 2, surface coal mining could impact two public roadways, eight overhead power lines, and five oil and gas pipelines. Temporary surface disturbance from mine support activities (e.g., topsoil stripping, soil stockpiling) in a 0.25-mile-wide buffer around the final tract configuration could affect one additional power line and two additional pipelines. Alternative 2 would have no impact on rail lines.

Two public roadways pass through the western half of the BLM study area (map 3.15-1). As described under the Proposed Action, above, and in sections 2.2.1.1 and 2.2.3.1, the coal reserves underlying the Collins and McGee Roads, their rights-of-way, and the associated 100-foot buffer zones are considered unsuitable for mining and cannot be accessed unless one or both roads are closed or relocated. Kiewit does not anticipate pursuing either of those options, and neither road is expected to be disturbed under this alternative. Unless an exception is granted to the BLM's unsuitability criterion 3, a stipulation would be attached to the lease stating that mining activity would not be conducted within the rights-of-way or 100-foot buffer zones for these county roads. Vehicular traffic to and from the Buckskin Mine would remain at existing levels, but would continue for up to six years beyond the current life-of-mine estimate.

Coal mined in the final tract configuration would be transported by rail. Mining would be an extension of existing operations and would rely on existing rail facilities and infrastructure. Annual coal production and volume of rail shipments would not increase, but rail shipments would continue for an additional six years beyond the current life-of-mine estimate. Several active oil and gas pipelines and electric corridors run through the BLM study area. Surface disturbance associated with construction would result if a pipeline is relocated. If relocation of these pipelines or corridors is necessary, it would be handled according to specific agreements between the coal lessee and the pipeline or utility owners.

Multiple power lines and active oil and gas pipelines would be affected under Alternative 2. Surface disturbance such as overland travel, topsoil stripping, trenching, and augering associated

with removal and relocation of associated infrastructure and facilities would result in varying levels of surface disturbance in current and new locations.

3.15.3 Regulatory Compliance, Mitigation, and Monitoring

Regulatory requirements regarding transportation facilities preclude any public road from being relocated or closed unless the appropriate authority has allowed it. Existing pipelines and oil and gas lines can be relocated, if necessary, in accordance with specific agreements between the coal lessee and the pipeline and utility owners. After mining, the land will be reclaimed to support the premining uses described in section 1.1.3.1. Oil and gas wells, pipelines, and utility easements will be reestablished as required.

3.15.4 Residual Impacts

With the opening of the PRB in Wyoming in the late 1970s, U.S. coal shipments have grown dramatically from 4.8 million carloads to 8.4 million carloads in 2006 as the railroads deliver low-sulfur coal to help electric utilities achieve clean air standards. The largest coal trains are from the PRB to power plants in Illinois, Missouri, and Texas (Federal Railroad Administration 2008).

Shifting and blowing coal dust and coal chunks coming off freshly loaded moving railroad cars can accumulate along railroad tracks, railroad rights-of-way, and on adjacent lands. Coal dust can wash into drainages where large deposits of lost coal can accumulate. Accumulated coal dust has been linked to train derailments and can spontaneously combust and cause wildfires.

Coal can be lost from rail cars through leakage from the rail car discharge doors, spillage over the rail car sides, or it can be blown from rail car tops during transit. In testing conducted by Union Pacific Railroad, BNSF, and the National Coal Transportation Association, the average loss of coal from an individual rail car's rapid discharge doors was about 19 pounds per 216 miles, or 0.09 pound per mile. The same testing indicated that an average of 225 pounds of coal was lost from the top of a coal car through either top spillage or being blown off during a 567-mile test trip, which equated to about 0.4 pound per mile (National Coal Transportation Association 2007).

The derailment of two trains in the PRB in 2005 resulted from track instability problems caused by a buildup of coal dust and other particles on the rail bed in combination with high concentrations of moisture (Union Pacific Railroad 2005). BNSF railway officials toured the PRB rail infrastructure in June 2007. According to a BNSF official, when coal dust is blown off rail cars, it becomes lodged in the rail bed, allowing moisture to intrude. The moisture then degrades the structural stability of the rail bed and leaves the rail more vulnerable to buckling under stress (Gartrell 2007a).

The National Coal Transportation Association (2007) testing results suggested that rail car bottom spillage may have more of a negative impact on rail bed stability than loss from the top

of rail cars since the leakage is directly above and near the ballast. The testing also indicated a 32% decrease in bottom spillage of coal after adjustment of the rapid discharge doors.

Accumulating coal dust deposits have become a concern in Converse County. While the coal mines north of Gillette, including the Buckskin Mine, ship most of their coal via the east-west BNSF Railroad to destinations in the Midwest, the majority of coal mined in the PRB travels through Converse County on railroads. Coal dust blows off the freshly loaded coal cars on their way from the mine load-outs to Bill, Wyoming, and through Converse County (Delbridge 2007). The Converse County Board of Commissioners is concerned with the coal dust piles that have accumulated in the county from rail transport of coal.

Spontaneous combustion of accumulated coal dust can cause rangeland fires. Smoldering coal dust in a railroad right-of-way can ignite a wildfire and quickly spread to surrounding private lands if the fire is not immediately controlled. The Douglas Volunteer Fire Department Chief, Rick Andrews, estimates that coal fires account for at least 50% of the department's average summer call volume and are an ongoing problem for them. Often water only temporarily puts down the flames; some fires repeatedly ignite over the course of several hours or days. While the county's rural fire district is compensated for some of the costs involved in putting out fires caused by transported coal, the compensation does not come close to the actual costs, according to the Douglas Volunteer Fire Department Chief (Delbridge 2007).

A Converse County private landowner invited the BLM to examine and survey the coal that had fallen from coal trains traveling through his land. On July 7, 2008, BLM personnel met with the landowner and toured his rangeland, which was adjacent to the railroad right-of-way, about 26 miles north of Douglas, Wyoming. The BLM surveyed various coal accumulations in Box Creek. One area had a coal accumulation 1.8 feet thick. Water runoff washed lost coal from the trains into drainages; the amount of coal deposited varied along the tracks (BLM 2008d).

BNSF is working with the utility companies and the mines to encourage delivery of larger chunks of crushed coal (3-inch versus 2-inch diameter) to reduce the amount of small particles that are created in the crushing process. Another possibility that may help lessen blowing coal dust from trains is the application of surfactant to the tops of loaded coal cars. When applied to coal, the surfactant can stabilize and adhere coal dust to larger coal chunks. Tests have shown that coal dust on railroad tracks can be reduced as much as 95% with surfactant use. The specific surfactant used must meet utility companies' burning specifications (Gartrell 2007a).

A collaborative effort between the the National Coal Transportation Association, PRB mines, and BNSF and UP railroads has resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load. Preliminary results have demonstrated that this new design may result in a 30% to 60% reduction in coal dust blowing off the top of cars during the early portion of the route (Union Pacific Railroad 2006).

Converse County Commissioners have formally expressed concerns to the BLM regarding fire, health, and safety issues associated with blowing coal dust from trains. They have stated that the health and wellbeing of Converse County citizens downwind of the railroad tracks continue to be

jeopardized by the lack of coal dust mitigation in the coal mining permit process. The commissioners have recommended that coal dust mitigation be applied as a standard condition of approval before mining permits are issued (BLM 2008e).

As discussed in section 1.3, the BLM does not authorize mining permits nor does it regulate mining operations with the issuance of a BLM coal lease. WDEQ/LQD is the agency that permits mining operations and has authority to enforce mining regulations. In Wyoming, WDEQ/LQD has entered into a cooperative agreement with the Secretary of the Interior to regulate surface coal mining operations. Mitigation and other requirements are developed as part of the mining and reclamation permit. These permits and the provisions they contain must be approved by WDEQ/LQD before mining of federal coal leases can occur.

Other agencies that may be stakeholders in this issue include the Federal Railroad Administration, which implements U.S. Department of Transportation environmental policies related to U.S. railroads, and the National Coal Transportation Association, whose mission includes facilitating the resolution of coal transportation issues to serve the needs of the general public and industry (National Coal Transportation Association 2008).

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste could include spilled, leaked, or dumped substances, petroleum products, and solid waste associated with coal and oil and gas exploration, oil and gas development, utility line installation and maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present in the general analysis area. Wastes produced by current mining activities at the Buckskin Mine are handled according to the procedures described in chapter 1, section 1.1.3.5.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action

Under the Proposed Action, hazardous and solid wastes generated in the course of mining the proposed tract would be similar to those currently being created by existing mining operations, but they would continue for two years beyond the current life-of-mine estimate. Wastes generated by mining the proposed tract would be handled in accordance with the existing regulations using the procedures currently in use, and in accordance with WDEQ/LQD-approved waste disposal plans at the Buckskin Mine (section 1.1.3.5).

3.16.2.2 Alternative 1 (No Action)

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Disturbance in the general analysis area

would be limited to its overlap with the existing Buckskin Mine permit area boundary, and would consist of temporary surface disturbance from activities (e.g., topsoil stripping) to support mining on existing leases, described in section 1.1.3.3. Coal removal and any associated waste production would continue on the existing Buckskin Mine leases. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

3.16.2.3 Alternative 2

Under Alternative 2, hazardous and solid wastes generated in the course of mining an alternative tract configuration would be similar to those currently being created by existing mining operations, but they would continue for up to six years beyond the current life-of-mine estimate. Waste handling and disposal procedures would be the same as those described for existing mining operations (section 1.1.3.5), and would be in accordance with WDEQ/LQD-approved waste disposal plans at the Buckskin Mine.

3.16.3 Regulatory Compliance, Mitigation, and Monitoring

Kiewit will adhere to the regulatory requirements for production, use, storage, transport, and disposal of solid waste and hazardous or extremely hazardous materials that result from mining activities, described in section 1.1.3.5. All mining activities involving hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

3.16.4 Residual Impacts

No residual impacts associated with hazardous and solid waste are expected.

3.17 Socioeconomics

This section describes existing socioeconomic conditions in Campbell County, the City of Gillette, and nearby unincorporated areas and identifies impacts on those conditions that would result from the Proposed Action and alternatives.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Wyoming's coal mines set a new annual production record of 466.3 million tons in 2008, an increase of about 14.2 million tons (3.1%) over the record 452.1 million tons produced in 2007. Coal produced from 14 active mines in Campbell and Converse counties accounted for approximately 96% of total statewide coal production in 2008 and virtually all of the gain in statewide production from 2007 to 2008 (Wyoming Department of Employment 2009a).

Energy resource development has been the primary stimulus behind a significant economic expansion across the state in recent years. Recent estimates of the state's gross state product

(GSP)[3] highlight the significance of the minerals industry to the statewide economy. Estimates of the 2007 GSP indicate the mining industry, including oil and gas and support activities, accounted for more than 30% of the state's total GSP of $31.5 billion. Statewide GSP climbed by nearly 45% (in nominal dollars) between 2003 and 2007 largely due to the increases in natural gas development and production. The contribution of mining production to the 2007 statewide GSP was more than twice that of the government sector, the next largest sector, and more than three-and-one-half times the contribution of the real estate industry, the next largest private industrial sector (U.S. Bureau of Economic Analysis 2009).

Wyoming, Campbell County, Campbell County School District 1, the City of Gillette, and many other governmental entities across the state receive revenues derived directly and indirectly from taxes and royalties on the production of federal coal, including that at the Buckskin Mine. Such revenues include lease bonus bids, ad valorem taxes, severance taxes, royalty payments, sales and use taxes on equipment and other taxable purchases, and portions of required contributions to the federal AML program and Black Lung Disability Trust Fund. Companies pay lease bonus bids for the right to enter into lease agreements for federal coal.

Current statutorily established allocation formulas presently cap the total annual distributions to local governments from the state's share at levels substantially below the revenues generated by mineral development in the state. Consequently, the bulk of such revenues accrue to the state general fund, budget reserve fund, Permanent Wyoming Mineral Trust Fund, and school foundation and construction budgets. The combined statutory distributions to cities and counties during fiscal year 2007 was $53.5 million, about 2.9% of the total $1.79 billion in federal mineral royalties and severance taxes received by the state. Moreover, distributions to local government are not earmarked for those local entities where the activities are located or the social and economic effects are felt. Instead, the distributions are made to all cities and counties in the state.

In 1994, a study conducted at the University of Wyoming estimated the total fiscal benefit to the State of Wyoming for coal produced in the PRB at $1.10 per ton (Borden et al. 1994). Calculating the estimated total fiscal benefit to the state in 2005 by including half of the bonus bid payments, half of the federal mineral royalties based on current prices, half of the AML fees, and all of the ad valorem taxes, severance taxes, and sales and use taxes for coal produced in Campbell County in 2005 results in an estimated $661 million, or $1.62 per ton (BLM 2006b).

Revenues to the federal government from leasing and production of federal coal include retention of one-half of the lease bonus bids and federal mineral royalties. Bonus bids are paid in five annual installments, with half returned to the state. In 2004 and 2005, BLM held competitive sealed-bid lease sales for six coal tracts (NARO South, Hay Creek, West Hay Creek, Little Thunder, West Roundup, and NARO North). The successful bonus bids for these six sales ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion, including

[3] GSP is a measure of the total market value of goods and services produced by the labor, capital, and property in the state, after netting out the value of intermediate outputs imported to the state.

$146.3 million for the Hay Creek tract (BLM 2006b). The bonus bid payments associated with these sales topped $200 million in fiscal year 2006. The remaining bonus bid payments from those past sales, estimated at about $170 million per year to the State of Wyoming, will occur this year and the next fiscal year.

Three sales involving coal in the Wyoming PRB were held in the first four months of 2008. Two of those sales were successful. The Eagle Butte and South Maysdorf tracts yielded bonus bids within the range of the 2004/2005 sales (BLM 2008f). As additional sales are planned, successful sales will generate additional coal lease bonus bid disbursements. Such disbursements to the state are then allocated to fund capital construction projects for cities, towns, and counties; the state's highway fund; community colleges, and schools (Wyoming Consensus Revenue Estimating Group 2007).

Federal mineral royalties (FMR) are collected by the federal government when the produced coal is sold, with a royalty rate equal to 12.5% of the sale price. The federal government retains 51% of the receipts and 49% of the FMR is disbursed to the State of Wyoming. Total FMR disbursements, including coal bonus bid payments to the state in fiscal year 2007 derived from all mineral production (not solely coal), was $927 million (Wyoming Consensus Revenue Estimating Group 2008). In 2006, the Buckskin Mine paid $17.8 million in FMR.

In addition to the FMR, coal mines pay as much as 31.5 cents per ton of surface coal produced to fund AML reclamation programs. The Buckskin Mine payments to the federal mining reclamation program exceeded $6 million in 2006. Historically about 83% of the funds were to be returned to states and tribes with AML problems, subject to adjustments to reflect the actual appropriations authorized by Congress and overall AML program priorities. Future AML payments associated with the proposed coal sales are assumed to be 28.0 cents per ton.

Wyoming historically received about 50% of the AML funds generated by production in the state. Amendments to Title IV of the SMCRA enacted in 2006 altered the structure of the AML program. Under the revised program, Wyoming will receive payments over the next seven years to replace past underpayments stemming from Congressional budget authorizations that were insufficient to fully fund the program. However, the state will not be entitled to receive future distributions from the AML program. Wyoming will receive an equivalent in-lieu amount, of 50%, in the form of grants from general treasury funds. The new funds will be subject to fewer restrictions regarding their use (OSM 2007a, b).

Additional sources of revenue from coal mining include federal corporate and personal income taxes and annual lease rentals paid to the government.

Sales and use taxes are levied by the state and by local governments. Approximately 70% of the revenues generated from the statewide 4.0% levy are retained by the state; the remaining revenues are distributed to the counties, cities, and towns according to statutory formula. In addition, Campbell County levies a 1% general purpose local option tax and a 0.25% specific county option tax. Sales and tax revenues are vital for local governments. Statewide total sales and use tax revenues totaled $922.1 million in fiscal year 2007. Fully $1 of every $6 in

statewide sales and use tax receipts was derived directly from economic activity in Campbell County (Wyoming Department of Revenue 2007). A direct accounting of sales and use taxes paid by coal mining firms is not available; however, it is likely substantial given the operating budgets of the mines.

In 2006, the Buckskin Mine had a total payroll, including benefits and incentives, of $19.3 million. In addition, the mine made outlays of nearly $91 million for non-labor operating expenses, capital investments, permits, licenses, fees, royalties, and taxes. Approximately 60% of the latter sum was spent with vendors and suppliers in Wyoming or paid directly to state and local governments. An internal analysis of the Buckskin Mine's outlays yielded an estimated $1.8 million paid in sales and use taxes in 2006. The total payroll includes $31.7 million in federal mineral royalties, mined land reclamation, and black lung taxes, a considerable portion of which return to Wyoming (Ackermann pers. comm.).

The County, Campbell County School District 1, and several special service districts also rely on ad valorem/property taxes levied on the real property and value of production and benefit from operations of the Buckskin Mine.

Rising production and market values for oil, natural gas, and coal, coupled with increases in production have given rise to dramatic increases in the ad valorem tax bases of producing counties, particularly Campbell County. In 2008, Campbell County had an ad valorem tax base of $4.72 billion, an increase of more than $1.0 billion, or 29% increase in the past three years. Campbell County's total ad valorem tax base accounted for more than 21% of the aggregate statewide assessed value on all real property and mineral production. The coal mining industry accounted for nearly 66% of Campbell County's total assessed value (table 3.17-1). The Buckskin Mine, along with other coal mines and the natural gas industry, are the largest taxpayers in Campbell County.

Table 3.17-1. Contribution of Coal Mining to 2008 Assessed Valuation of Campbell County

Total Assessed Value	Coal Mining (Real Property)	State-Assessed Minerals—Coal	Coal-Related Share of Total[1]
$ 4,772,822,444	$ 258,857,305	$ 2,852,086,593	65.8%

[1] (coal mining real property + state-assessed minerals) / total assessed value = coal-related share of total

Sources: Wyoming Department of Revenue 2008 and Wyoming State Board of Equalization 2008.

3.17.1.2 Environmental Consequences

Federal and state royalties, severance tax, and other revenues generated by leasing and mining coal depend on the eventual sale date and price of coal. This analysis assumes a conservative price estimate of $7.85 per ton of coal. It is approximately 25% below the statewide average price of $10.56 per ton for 2010 thru 2012 (reflecting both contracted and spot sales prices) used by Wyoming's Consensus Revenue Estimating Group to estimate the state's revenues from mineral severance and federal mineral royalty revenues over the next five years (Wyoming Consensus Revenue Estimating Group 2007, 2008). Royalty and severance tax revenues would

increase above the amounts projected in this analysis should actual values be higher, and vice versa. Coal prices increased in 2005, generally in response to concerns over transporting and maintaining adequate stockpiles, but then declined in 2006. According to the Wyoming State Geological Survey, the average spot price of 8,400-Btu coal in the PRB was $11.06 per ton in the second half of 2005 and $9.86 per ton in 2006 (Wyoming State Geological Survey 2008). Prices trended upward in 2007 and the first half of 2008, topping $14.00 per ton for 8,800-Btu coal in April and again in November (U.S. Department of Energy 2008a).

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract[4] is projected to generate $69.2–$87.3 million in federal revenues, $90.6–$108.8 million in state and local revenues (table 3.17-2), and potential bonus bids on the leased recoverable coal ranging from $0.30 to $0.97 cents per ton. The projected revenues are based on the total tons of recoverable coal, and, therefore, are not affected by future production rates.

Table 3.17-2. Projected Major Revenue Increases under the Proposed Action and Alternatives[1]

Item	Existing Buckskin Mine	Additional Under: Alternative 1 (No Action)	Additional Under: Proposed Action	Additional Under: Alternative 2
State and Local Revenues	$563.6 million	0	$90.6–$108.8 million	$250.2–$300.4 million
Federal Revenues	$417.0 million	0	$69.2–$87.3 million	$191.0–$241.1 million
Mine Life	14 years	0	2 years	6 years
Additional Employees	0	0	0	0

[1] Includes severance taxes, federal mineral royalties, and payments to the AML and Black Lung Disability funds. Revenues assume an average sale price of $7.85 per ton for coal. State and local revenues include allowances for "in-lieu" amounts for AML, for sales and use taxes on direct purchases by the mine, and ad valorem/property taxes on real property and production, but not the sales and use taxes associated with the indirect and induced activity supported by the mine. The state revenues do not include any allowances for "recapture" revenues from Campbell County School District 1.

The overwhelming majority of the state and local revenues reported above would accrue to the state general fund, budget reserve, and Permanent Wyoming Mineral Trust Fund. Substantial revenue would also go to the Wyoming School Foundation Program and school construction programs. Due to statutorily established "caps" on distributions of federal royalty and severance tax revenues to local government, only a relatively small share of these revenues would go to Campbell County and the City of Gillette.

The Wyoming School Foundation Program is also likely to benefit from revenues generated by the "recapture" provisions of local ad valorem taxation. These provisions are triggered when local school districts collect revenue based on state-mandated property tax levies for education that exceed authorized expenditure levels under the state's funding equalization program. These

[4] Based on the coal production tonnages shown in table 3-1.

provisions require such excess tax revenue to be forwarded to the state for use in funding operations in districts with relatively smaller property tax bases. Campbell County School District 1 is among the few districts in the state that is consistently subject to the "recapture" provisions.

Under the Proposed Action, the local economic activity supported by the mine's wages and local purchases would continue for two years beyond the current life-of-mine estimate.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Currently approved mining operations and associated economic benefits would continue on the existing Buckskin Mine leases for the current life-of-mine estimate; however, the additional years of economic and fiscal benefit under the action alternatives would be lost.

As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future. Successfully leasing the tract in the future would trigger the same types of revenue flows to the federal, state, and local governments, though the magnitude of the revenues could be higher or lower than reported here due to differences in future market prices for coal, tax rates, and other factors.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area[5] would generate \$191.0–\$241.1 million in projected federal revenues, \$250.2–\$300.4 million in state and local revenues (table 3.17-2), and potential bonus bids on the leased recoverable coal ranging from \$0.30 to \$0.97 cents per ton. The projected revenues are based on the total tons of recoverable coal and hence are insensitive to future production rates.

Allocation of revenue would be the same as described for the Proposed Action.

Under Alternative 2, the local economic activity supported by the mine's wages and local purchases would continue for six years beyond the current life-of-mine estimate.

3.17.2 Population

3.17.2.1 Affected Environment

Future residency patterns of the Buckskin Mine's employees would be expected to mirror that of the mine's current workforce. More than 80% of the current workforce resides in or near Gillette, with 12% living elsewhere in Wyoming, and 8% commuting from locations in South Dakota. Because of the proximity of the mine to Gillette, the company does not sponsor bus service for employees to and from the mine as do some of the other mines in the region. Rather, employees drive personal or company vehicles or participate in informal carpools.

[5] Based on the coal production tonnages shown in table 3-1.

The community of Gillette, the county seat, would most likely attract the majority of any new residents due to its current population levels and the availability of services, shopping amenities, and educational institutions.

Campbell County's population climbed from 33,698 in 2000 to an estimated 41,473 in July 2008, ranking it the third most populous of Wyoming's 23 counties (table 3.17-3). The increase represents 23% net growth since 2000, trailing only Sublette County (43%) in terms of population growth rates among Wyoming counties. However, Campbell County ranked first in terms of net absolute population growth with a net gain of 7,775 residents. Natrona County, where Casper, the state's largest city is located, registered the second-largest absolute change, gaining 6,596 residents between 2000 and 2008 (U.S. Census 2009).

Table 3.17-3. Population Change, 2000 to 2008

					Change Since 2000	
	2000	2006	2007	2008	Absolute	Percent
Campbell County	33,698	38,480	40,433	41,473	7,775	23.1
City of Gillette	19,646	23,264	25,031	NA	5,385*	27.4

NA = Not yet available

Source: U.S. Census (2008a and 2009).

* Indicated change is for the period 2000 to 2007.

Gillette's July 2007 population of 25,031, as reported by the U.S. Census Bureau, ranks it the fourth-largest city in the state, behind Cheyenne, Casper, and Laramie. Gillette's net population gain of 5,385 residents led all municipalities in the state by a considerable margin; Casper's net gain of 3,359 residents was the second-largest increase among Wyoming cities and towns (U.S. Census 2008a).

The City of Gillette has long maintained that the Census Bureau population estimates are low. The city's population estimates were 27,533 and 30,636, respectively for December 2006 and 2007: the latter is more than 5,600 residents higher than the census estimates. The city cites updated housing inventories, household demographics, and the extremely low housing vacancy rates for its higher estimates (City of Gillette 2008a). Beyond the direct implications for population, the latter also suggests that the Census estimates overlook households that would qualify as residents but are unable to find housing and consequently are living in local hotels and motels on a longer-term basis (Langston pers. comm.). The city also believes the Census estimates overlook the many single-status workers who reside in the community on a long-term basis, but who maintain a permanent legal place of residence elsewhere.[6] Though they technically are not residents, these individuals place demands on the city and other local public service providers.

[6] Single-status workers are married with spouses or families, or are unmarried but living in household settings, who relocate temporarily for employment purposes but who are not accompanied by other family or household members.

In comparison to the statewide population, the median age of Campbell County residents was substantially lower and it had relatively fewer minority residents, a higher percentage of residents under 18, and a larger average household size as shown in table 3.17-4.

Table 3.17-4. Demographic Characteristics, 2000

Characteristic	Wyoming	Campbell County
Median Age	36.2	32.2
Percent Residents < 18 Years Old	26.1	31.0
Average Household Size	2.5	2.7
Percent Minority Residents	7.9	3.9
Source: PRB Coal Review Task1C Report (BLM 2005b)		

The majority of the current population directly and indirectly associated with the Buckskin Mine's current workforce resides in and is already integrated into the Gillette community.

3.17.2.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract would extend the current life-of-mine estimate by two years, but mine employment would be expected to remain the same as under existing conditions (section 1.1.3.2). Consequently, the Proposed Action would not result in any noticeable incremental change in population in Campbell County, the City of Gillette, or nearby unincorporated areas.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Currently approved mining operations and associated employment levels would continue on other existing Buckskin Mine leases. The extension in the life of the mine and associated benefits on population stabilization would be lost. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining in the BLM study area would extend the current life-of-mine estimate by up to six years, but mine employment would be expected to remain as described under existing conditions (section 1.1.3.2). Consequently, Alternative 2 would not result in any noticeable incremental change in population in Campbell County, the City of Gillette, or nearby unincorporated areas.

3.17.3 Employment

3.17.3.1 Affected Environment

Coal mining processes and productivity have changed substantially in recent times. New technologies and higher-capacity equipment are major contributors to these changes. Local coal mining employment grew rapidly during the 1970s as more mines opened and production climbed. Between 1980 and 1998, overall production rose while the number of mining employees decreased or remained constant. The employment declines followed major capital investments in facilities and production equipment aimed at increasing productivity (BLM 2005b). Since 1998 direct employment in Powder River coal mines has climbed, but relatively slower than production, which has risen by more than 50% (Wyoming Department of Employment 2009a).

At the beginning of 2008, the mining sector, including oil and gas workers, accounted for more than 26% of all wage and salary jobs in Campbell and neighboring Converse counties, more than two-and-one-half times the statewide percentage. Surface coal mines or coal contractors in those two counties directly employed approximately 7,400 people, representing about 23% of the total employment labor force (Wyoming Department of Employment 2009a, 2009b; U.S. Bureau of Labor Statistics 2009).

Total statewide covered employment[7] stood at 276,195 in the first quarter of 2008, nearly 20% higher than the corresponding 230,554 jobs in 2003. Approximately one-out-of-four new jobs added in the state during the five-year period was related to the energy industry, with most of that increase concentrated in support industries for oil and gas development.

During that same period, statewide coal mining employment increased by 1,809 jobs (27%) to 6,614, while total employment in Campbell County grew by 8,010 jobs (29%) (Wyoming Department of Employment 2009b). The recent increases in the numbers of local jobs has affected all industries, but was concentrated in mining, construction, transportation, and local government (Wyoming Department of Employment 2009b and 2009c). The mining sector, which includes the oil and gas industry, accounts for about 28% of all employment and 39% of the total labor wages paid in Campbell County. Coal mining is the major constituent of the mining industry in Campbell County, unlike most other areas of Wyoming where oil and gas development is the primary constituent.

Local labor market conditions reflect the strong economic expansion in recent years, driven principally by energy resource development. Unemployment has been near historic lows with average unemployment dipping below 2.0% in Campbell County in 2008, even as the local labor force has grown due to immigration and the attraction of additional residents into the labor force (U.S. Bureau of Labor Statistics 2009).

[7] Covered employment refers to those full- and part-time, private and government wage and salary workers covered under the state's unemployment insurance program. About 97% of non-agricultural workers are included. Exclusions include insurance and real estate agents on commission; most railroad workers; the self-employed; unpaid volunteers or family workers; members of the military; and many agricultural workers.

The Buckskin Mine provides work for 338 (October 2008) employees. The current employment level resulted from an increase of about 130 employees following the 2004 acquisition of additional reserves in the West Hay Creek coal lease and subsequent increase in production. The mine also purchased additional mining equipment to boost production as it worked to address increased stripping ratios (overburden to coal ratio) in its active production seams. Although the primary purpose of the proposed tract is to support an efficient transition of mining from the current production area to other existing leases, the expansion in reserves associated with the tract would also extend the life-of-mine by two years at current production rates (about 25 million tons per year). The additional reserves associated with Alternative 2 would add up to six years to the life of the mine.

The Buckskin Mine is contemplating the addition of a few additional employees to reach its currently desired staffing levels. Filling these positions, a part of the No Action Alternative, would raise the workforce to 345 to 350 workers (Ackermann pers. comm.). Little or no further change in direct employment is anticipated at the mine in conjunction with either the Proposed Action or Alternative 2, assuming a sustained annual production of 25 million tons per year.

3.17.3.2 Environmental Consequences

Proposed Action

Under the Proposed Action, surface coal mining in the proposed tract would extend the current life-of-mine estimate by two years, but mine employment would be expected to remain the same as under existing conditions (section 1.1.3.2). Consequently, the Proposed Action would have a beneficial impact on the region's labor market by extending the duration of current employment rates at the mine.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Current mining operations and employment levels would continue in association with other existing Buckskin Mine leases. The extension in the life of the mine and associated benefits on continued employment would be lost. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, surface coal mining in the alternative tract configuration would extend the current life-of-mine estimate by up to six years, but mine employment would be expected to remain the same as under existing conditions (section 1.1.3.2). Consequently, Alternative 2 would have a beneficial impact on the region's labor market by extending the duration of current employment rates at the mine.

3.17.4 Housing

3.17.4.1 Affected Environment

The 2000 census tallied 13,288 housing units in Campbell County (U.S. Census 2008b). Population growth since 2000 has prompted new housing construction in the region. According to the Census Bureau estimates, net additions to the number of housing units in Campbell County from 2000 through 2007 total 1,240 units (table 3.17-5). However, for many years construction did not keep pace with demand. Consequently, vacancy rates have fallen to record lows and housing prices have climbed. In the second half of 2007, a survey of rental housing estimated a vacancy rate of just 0.3% (4 units) in Campbell County (Wyoming Housing Database Partnership 2008). Another recent housing survey in Gillette yielded a vacancy rate of 0.1% for rental properties with many complexes reporting significant waiting lists. That survey also estimated a year-end vacancy rate of 2.0% among 11 mobile home parks (City of Gillette 2008a).

Table 3.17-5. Campbell County Housing Inventory, 2000 and 2007

2000	2007	Change
13,288	14,528	+1,240

Source: U.S. Census 2008b

In 2007, a major surge in new residential construction occurred in Campbell County, triggered by pent-up housing demand and anticipated future demands associated with the pending construction of the Dry Fork Station power plant (2008 thru 2010), rising coal production, and continuing natural gas development. The City of Gillette alone issued 986 building permits for new housing units in 2007. That total, consisting of 244 single-family units, 140 duplex units, and 602 multi-family units, nearly equaled the combined total of the previous six years. In addition, the city issued 126 permits for new manufactured homes. At year's end 624 multifamily units were under construction with another 72 units expected to be permitted in early 2008 (City of Gillette 2008a).

In the fourth quarter of 2007, average rental housing costs in Campbell County were $708 for a two-bedroom, unfurnished apartment; $308 for a single-wide mobile home lot; and $1,185 for a two- or three-bedroom single-family home. As compared to the same period in 2006, those averages represent increases of 1.5%, 9.1%, and 21.6% for apartments, mobile home lots, and single family homes, respectively. Within the state, only Teton and Sublette counties have higher costs (Wyoming Department of Administration and Information 2008).

The average selling price of homes in Campbell County in 2006, based on 436 sales, was $199,945. That average was the fifth highest among Wyoming counties, a 7.6% increase over 2005, and an overall increase of 52% in five years (Wyoming Housing Database Partnership 2008).

In addition to permanent housing, a substantial number of temporary or transient housing exists in Campbell County, the City of Gillette, and nearby unincorporated areas. Such housing includes hotels or motels, campgrounds, and some spaces within recreational vehicle (RV)/mobile home parks. Given the tight housing market conditions in Gillette, workers and families waiting for traditional housing to become available are reportedly using some units for longer-term occupancy.

Gillette currently supports 18 motels and inns offering a total of about 1,370 guest rooms; Wright recently opened a 27-room motel (Wyoming Travel and Tourism 2007). Commercial construction permits for a new 80-room motel and a new dormitory to house railroad employees were also issued in 2007 (City of Gillette 2008a).

Gillette has two year-round, commercial campgrounds with approximately 135 hookups for RVs plus tent areas (Wyoming Travel and Tourism 2007). In an effort to address current and anticipated housing needs (particularly those associated with temporary workforces for power plant construction and oil and gas development) Campbell County amended its zoning regulations in 2007 to include a new district for recreational vehicle parks. Such parks can accommodate travel trailers, campers, motor homes, and other recreational vehicles that are commonly used as housing, in a setting that offers centralized laundries, showers, and recreational support activities, as well as utility service and hookups (Campbell County 2008b).

3.17.4.2 Environmental Consequences

Proposed Action

Under the Proposed Action, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be extended by two years beyond the current life-of-mine estimate. Production levels would remain at 25 million tons per year, so no increase in workforce would be necessary to accommodate this rate. Current efforts to add a small number of employees at the mine are unrelated to the coal lease application. Consequently, the Proposed Action would have no substantial impact on population influx or new demands on housing resources in Campbell County, the City of Gillette, and nearby unincorporated areas.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Little change on local housing resources would be expected due to the lack of change in employment at the Buckskin Mine under this alternative. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be extended by up to six years beyond the current life-of-mine estimate. Production levels would remain at 25 million tons per year, so no

increase in workforce would be necessary to accommodate this rate. Production levels would remain at 25 million tons per year, so no increase in workforce would be necessary to accommodate this rate. Current efforts to add a small number of employees at the mine are unrelated to the coal lease application. Consequently, Alternative 2 would have no substantial impact on population influx or new demands on housing resources.

3.17.5 Local Government Facilities and Services

3.17.5.1 Affected Environment

The availability of revenues generated by mineral production has helped local government facilities and services address growing demands for public services. Current facilities and services are generally adequate for the current population, although several service providers are engaged in expansion plans to accommodate future growth and improve service delivery.

Campbell County School District 1, the third-largest district in Wyoming in total enrollment, is the public school district most directly affected by operations at the Buckskin Mine. Total enrollment in Campbell County School District 1 declined by more than 500 students between 1998 and 2004, and climbed by 390 students through the fall of 2007 in response to economic and population growth in the county (Wyoming Department of Education 2008a). The enrollment increase is marked by a disproportionate increase in the number of very young children, i.e., the total number of students enrolled in kindergarten through third grade accounting for more than 70% of the net increase. This pattern is indicative of the recent migration by younger households into the area.

Campbell County School District 1 facilities include 15 elementary schools, 2 junior high schools, and 2 high schools (one with two campuses in Gillette). The school district is in the midst of a five-year plan to replace several schools, modernize others, and complete other major systems maintenance and upgrades. The overall plan is budgeted at more than $57 million. Plans for the next two years include completion of a new elementary school and additions to a high school (Wyoming School Facilities Commission 2007).

The Campbell County Sheriff's Department and Gillette Police Department are the two primary local law enforcement agencies in the county. In addition to general law enforcement throughout the county, the Sheriff's staff provides court security, conducts criminal investigations, operates the detention center, and provides animal control and dispatch for multiple entities.

The Sheriff's office is budgeted for 60 sworn deputies and other employees. Campbell County is proceeding with a major expansion and remodel of the Campbell County detention center. The existing facility has 128 beds, with separate modules for women and juveniles (BLM 2005b). The expansion will add 144 beds for adult inmates along with a separate 16-bed facility for juvenile offenders. Additional space for detention center support functions and departmental administrative, dispatch, and records storage are also included in the expansion (Campbell County 2008a).

The Gillette Police Department has primary responsibility for law enforcement within the municipal boundaries. The department had 70 full-time positions in 2007, an increase of 10 positions as compared to 2005. In part, the increase reflects heightened demands for services associated with a rapid influx of energy-related workers and the corresponding population growth (City of Gillette 2008b).

Fire suppression, fire safety, first responder medical emergency, and hazardous material response throughout Campbell County is provided by the Campbell County Fire Department, which is governed by a city-county joint powers board. The department maintains four stations in Gillette and six rural stations dispersed throughout the county. Construction of a new departmental headquarters facility commenced in 2007. The facility includes administrative office space, training facilities, parking bays for apparatus, and maintenance and storage facilities (City of Gillette 2008a). The Buckskin Mine maintains equipment and trained staff to fight fires on mine property.

The primary medical care facility serving the region is the Campbell County Memorial Hospital, a 90-bed acute care hospital, located in Gillette. The hospital is planning for a major expansion and renovation project that will add 73 new rooms, as well as other diagnostic, treatment, patient-care, and support facilities. Local health care capabilities include a nursing program at Gillette College, housed in a newly completed facility, built by the city. The new Health Science Center provides opportunities for expanded cooperative teaching and training between the college and the hospital.

Ambulance service for Campbell County is provided by the hospital, which has a 24-hour emergency service capability. The Campbell County Fire Department provides first responder service to emergency calls, but transport is the responsibility of the hospital-affiliated ambulance service. Emergency air transport service for severe injuries or critically ill patients is available through Wyoming Life Flight, based in Casper, Wyoming. Wyoming Life Flight provides transport to Wyoming Medical Center, a level 2 trauma facility, and other appropriate regional health care facilities in Billings, Montana, Denver, Colorado, or elsewhere.

The principal water and wastewater utilities are operated by the City of Gillette. The city's water system has ample capacity for its service area for most of the year. However, the system operates near capacity during the peak demand months of June, July, and August. The city recently completed a level II water study to identify longer-term solutions to its water supply problems and is now proceeding to implement its recommendations. High-priority actions include drilling a new well, promoting additional conservation through education and new rate structures, and adopting outside watering/irrigation schedules during the summer (Petersen pers. comm.; City of Gillette 2008a).

Gillette's sewer treatment system was originally designed for a service population of approximately 35,000. Recently completed improvements increased treatment capacity to accommodate a population of 50,000. The city is also proceeding with plans to expand/extend major sewer lines to provide capacity to accommodate new development. Currently, the system

serves in excess of 30,000 residents and visitors in the city and surrounding areas (City of Gillette 2008a).

3.17.5.2 Environmental Consequences

Proposed Action

Under the Proposed Action, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be extended by two years beyond the current life-of-mine estimate. Current efforts to add a small number of employees at the mine are unrelated to the coal lease application. Consequently, the Proposed Action would not increase demands on the existing community facilities or services in the county

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Demand on local government facilities and services would be the same as under existing conditions. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be extended by up to six years beyond the current life-of-mine estimate. Current efforts to add a small number of employees at the mine are unrelated to the coal lease application. Consequently, Alternative 2 would not increase demands on the existing community facilities or services in the county.

3.17.6 Social Setting

3.17.6.1 Affected Environment

The social setting for coal development in the PRB is described in the Task 1C Report for the PRB coal review (BLM 2005b)[8]. That report emphasizes Campbell County and its communities as the nucleus for coal development in the PRB. The Buckskin Mine has been in production since 1981, and the mine and its employees contribute to the social and economic stability of Campbell County and the City of Gillette.

3.17.6.2 Environmental Consequences

Proposed Action

Under the Proposed Action, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be maintained for up to two years

[8] This report is available online at http://www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal/prbdocs.html.

beyond the current life-of-mine estimate. Consequently, the Proposed Action would not affect the social setting of Campbell County or local communities, but would contribute to sustaining it for two additional years.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. The social setting would be the same as under existing conditions. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Under Alternative 2, employment at the Buckskin Mine would be expected to remain the same as under existing conditions (section 1.1.3.2), but would be extended by up to six years. Consequently, Alternative 2 would not affect the social setting of Campbell County or local communities, but would contribute to sustaining it for six additional years.

3.17.7 Environmental Justice

Environmental justice is concerned with actions that have disproportionate impacts on a given segment of society as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations," was published at 59 *Federal Register* 7629. That executive order requires federal agencies to identify and address unreasonably high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations (defined as those living below the poverty level). The executive order makes it clear that its provisions apply fully to Native American populations and Native American tribes.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area may have concerns about the presence of surface coal mines in the area. Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning environmental justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with consultation and coordination described in section 1.6. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately high and adverse impacts on minority and/or low-income groups, including Native Americans.

3.17.7.1 Affected Environment

Economic and demographic data (U.S. Census Bureau 2000 and 2006a) indicate that neither minority populations nor people living at or below the poverty level make up a "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole. Also, the Native American population is smaller than in the state as a whole, and no known Native American sacred sites are located on or near the general analysis area (section 3.12.2.1).

3.17.7.2 Environmental Consequences

Proposed Action

Because neither minority populations nor people living at or below the poverty level make up a "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, the Proposed Action would not have an adverse effect associated with environmental justice.

No Action Alternative

Under the No Action Alternative, the coal lease application would be rejected and no new coal reserves would be mined in the general analysis area. Because neither minority populations nor people living at or below the poverty level make up a "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, the No Action Alternative would not have an adverse effect associated with environmental justice. As discussed in section 2.2.2, a decision to reject the coal lease application would not preclude an application to lease a tract in the general analysis area in the future.

Alternative 2

Because neither minority populations nor people living at or below the poverty level make up a "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, Alternative 2 would not have an adverse effect associated with environmental justice.

3.17.8 Regulatory Compliance, Mitigation, and Monitoring

Surface coal mines are required to pay royalty and other taxes and fees as required by federal, state, and local regulations. The BLM compares the amount of coal reported as produced with the estimated amount of coal in the ground to verify that royalties are paid on all of the coal that is mined.

3.17.9 Residual Effects

3.17.9.1 Human Health Impact Assessment

In 2008, public concerns were brought to the BLM's attention in regard to conducting human health impact assessments in the PRB where coal mining activities occur. These public concerns included emissions from coal mining activities, such as particulate matter and NO_x exposure, and their potential impact on the health of people living in the local area.

Health impact assessments examine and assess the potential effects of proposed projects on human health on a broad scale, including social, emotional, and cultural, and physical impacts. These assessments rely on available scientific data, public testimony, and modeling to predict potential health impacts. The BLM does not have jurisdiction in regard to conducting human health assessments. However, the BLM has invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the draft EIS for the Hay Creek II Coal Lease Application.

In reference to the stated public concerns, air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed actions such as coal mining comply with all associated air quality regulations and criteria. The WAAQS are stricter than the NAAQS and are enforced by the WDEQ/AQD.

As described in section 3.4.2.3, the WDEQ/AQD in a joint effort with PRB mining stakeholders developed a detailed natural events action plan for the coal mines of Campbell and Converse counties, Wyoming, based on EPA natural event policy guidance. It identifies potential control measures for protecting public health and minimizing exceedences of the PM_{10} NAAQS.

All mines are required to conduct long-term air quality modeling to show that their proposed operations will comply with the NAAQS and WAAQS. They are also required to conduct regular monitoring to demonstrate that their actual air emissions do not exceed these standards. The WDEQ/AQD permit process for coal mines requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Section 3.4.2.3 contains air quality mitigation measures that WDEQ/AQD implemented to prevent exceedences of NAAQS and WAAQS by surface coal mines.

3.18 The Relationship Between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

Under NEPA, an EIS must include a discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2) (BLM 2008b). This section provides a summary of the residual

impacts of surface coal mining (short-term use) on those resources that have some long-term production capability. Resources such as geology, paleontology, surface water, wildlife use, and others considered "non-producing" are not included in this section.

3.18.1 Local Area

3.18.1.1 Topography

If either action alternative is implemented, coal mining activities would modify almost all components of the present ecological system in the mined tract, which have developed over a long period. In the long term, the land surface would be topographically lower following reclamation. Although the reclaimed surface would resemble original contours, it would have a more homogenous appearance and lack some of its original diversity in shape, structure, and outline.

3.18.1.2 Coal Bed Natural Gas

CBNG is currently being recovered from within the general analysis area, and the BLM's overall assessment of this resource suggests that a large portion of the CBNG resource in the area has been recovered or would be recovered prior to mining under either of the action alternatives. CBNG resources that have not been recovered from the Canyon and Anderson seams prior to mining would be lost when the coal is removed. Luca Technologies Inc. has developed a method of using methanogenisis to produce biogenetic methane. This technique is currently capable of producing up to 30 million cubic feet per day through nutrient enhancement of microbacterial communities; the bacteria metabolize the complex organic molecules in hydrocarbon deposits and produce the gas as a waste product.

Selection of the No Action Alternative (Alternative 1) would not be likely to decrease the total U.S. methane emissions attributable to coal mining in the long term, because numerous other sources of coal exist that could meet the demand even after the Buckskin Mine recovered all of the coal in its existing leases. Likewise, it would not be likely that total U.S. methane emissions would measurably increase in the long term if one of the action alternatives is implemented, because the annual production rate would not increase under either alternative.

3.18.1.3 Air Quality and Visual Resources

Because annual coal production rates and supporting mining activities would continue at current levels under either action alternative, they would not increase existing impacts on the air quality and visual resources in the area on a short-term basis. However, existing effects would continue for two to six years beyond the current life-of-mine estimate. No residual impacts on air quality or visibility are expected following coal extraction, removal of surface facilities, and completion of reclamation.

3.18.1.4 Water Resources

If either of the action alternatives is implemented, groundwater quality after reclamation may differ from premining conditions, but would be similar to the quality in previously reclaimed areas. Water quality would remain adequate for current uses such as livestock and wildlife. Mining would permanently remove any aquifers in the final tract configuration. Groundwater depth would increase in an area extending northwest (upstream) of mining operations due to drawdown from dewatering prior to mining, but should eventually return to premining levels because recharge areas would not be disturbed during coal recovery.

3.18.1.5 Vegetation

The forage and associated livestock grazing present in the general analysis area would be temporarily and incrementally disturbed during mining and reclamation. Croplands and pasture in the area would also be affected. Impacts on native vegetation and producing agricultural lands could occur on up to 2,847 acres due to mining and support activities (e.g., topsoil stripping, soil stockpiling), if the largest possible tract configuration is mined. However, because the county roads in the area are not likely to be closed or relocated, actual new disturbance is expected to be limited to a maximum of 618 additional acres (table 2-4). Any disturbance would occur incrementally over a period of years. Soils would be replaced and vegetation would be restored, as required by the mining plan (section 3.8 and section 3.9). Because the general analysis area is dominated (71% combined) by upland grassland communities and agricultural lands, the establishment of reclaimed grassland communities after mining has been completed would represent similar or somewhat improved habitats, respectively, compared to premining conditions. In the long term, reclaimed lands would provide equivalent or better forage production capacity for domestic livestock. This outcome would be required before the performance bond is released. Long-term productivity would depend primarily on postmining range management practices largely controlled by private landowners.

3.18.1.6 Wildlife and Wildlife Habitat

If either of the action alternatives is implemented, mining would disturb foraging habitat for a variety of wildlife species, particularly those associated with upland grasslands (the combined dominant habitat in the area). Sagebrush obligates such as the sage-grouse would not experience the same level of impacts due to the limited presence (approximately 11%) and broken distribution of shrubs in the general analysis area. Although some wildlife would be displaced or lost in the short term, monitoring of previously reclaimed lands indicates that reclamation can support levels of wildlife abundance and species richness similar to those present prior to mining disturbance over the long term. The timeline for the return to premine wildlife use varies widely by species, with the shortest period for grassland species and longest for species that depend on mature sagebrush, such as the sage-grouse and pronghorn.

3.18.1.7 Recreational Resources

If either of the action alternatives is implemented, short-term impacts on recreational resources could occur from a reduction in big game populations resulting from habitat disturbance and reduction in access to some hunting areas. However, hunting opportunities are already limited due to the dominance of private lands in and around the general analysis area, so these impacts would be minimal. Reclamation efforts would eventually restore wildlife habitats similar to premining conditions, and access to hunting areas affected by mining would presumably be restored as well. Consequently, no long-term adverse impacts on recreation would be expected.

3.18.1.8 Socioeconomic Resources

If either of the action alternatives is implemented, the short- and long-term economy of the region would be enhanced. The Proposed Action would extend the current life-of-mine estimate by two years; Alternative 2 would extend it up to six years (Table 2-4).

3.18.2 Human Health Impact Assessment

In 2008, public concerns were brought to the BLM's attention in regard to conducting human health impact assessments in the PRB where coal mining activities occur to assess the potential impacts of proposed projects on human health. These assessments examine health on a broad scale, including social, emotional, and cultural impacts as well as physical impacts. The impact assessments rely on available scientific data, public testimony, and modeling.

The BLM does not have jurisdiction in regard to conducting specific human health assessments. However, that agency invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the Hay Creek II Coal Lease Application EIS. Neither agency was able to provide detailed information due to time and staffing constraints. Information regarding general aspects of human health impact assessments are included in sections 3.4 (Air Quality), 3.5 (Water Resources), 3.14 (Noise), 3.16 (Hazardous and Solid Waste), and 3.17 (Socioeconomics). While this information may not provide a thorough discussion of all aspects of these assessments, it is a summary of credible scientific data and evidence that is relevant to evaluating reasonably foreseeable significant impacts on human health.

Public concerns were largely focused on the potential for exposure to particulate matter and NO_x emissions from coal mining, and the potential impacts of such exposures on the health of people living in the vicinity of surface coal mines located in the eastern PRB.

Air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed actions like coal mining comply with all associated air quality regulations and criteria. Wyoming standards, WAAQS are stricter than their national counterparts, NAAQS, and are enforced by the WDEQ/AQD. As described in section 3.4.2.3, the WDEQ/AQD developed a Natural Events Action Plan for the coal mines of the PRB. The plan, based on the EPA Natural Event Policy guidance, identifies potential control measures for protecting public health and

minimizing exceedances of the PM_{10} NAAQS, which is the only particulate emission required to be monitored at this time.

All mines are required to conduct air quality modeling to show that their proposed operations will comply with the WAAQS and NAAQS, and they are required to demonstrate through monitoring that their actual air emissions do not exceed the standards. The WDEQ/AQD coal mining permit process requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Section 3.4.2.3 addresses air quality mitigation measures that the WDEQ/AQD has implemented to prevent exceedances of the WAAQS and NAAQS at other PRB surface coal mines.

As stated above and as discussed in section 3.4, maintenance of current annual coal production rates and supporting mining activities under either action alternative would mean that ongoing, short-term impacts on air quality would not increase. However, ongoing impacts would continue for two years beyond the current life-of-mine estimate under the Proposed Action and up to six years under Alternative 2. No residual impacts on air quality are expected following coal extraction, removal of surface facilities, and completion of reclamation.

According to section 3.5.1, postmining groundwater quality may differ from premining quality, but is expected to be quite similar to the premining overburden aquifer and meet Wyoming Class III standards for use as stock water.

While mining is in progress, surface water quality (section 3.5.2) would continue to be protected by directing surface runoff from affected areas to various sediment-control structures including sediment ponds, traps, ditches, sumps, and mine pits. Under normal conditions, exceedances of effluent limitations are not expected in the future as mining extends into new drainages and additional sediment-control facilities are added. After mining and reclamation are complete, surface water flow and quality would approximate premining conditions.

Noise levels in the general analysis area would not increase near most occupied residences in the vicinity; however, existing activities such as blasting, loading, and hauling would continue for two years beyond the current life-of-mine estimate under the Proposed Action, and up to six years under Alternative 2. Projected noise in the general analysis area would be farther from some homes than currently allowed within the existing permit area. The distance and terrain between occupied homes and disturbance area provide visual and audio barriers to the north and west of the general analysis area. Due to the general remoteness of the area, and because mining is already occurring there, noise would have few off-site impacts. No residual noise impacts are expected.

As discussed in section 3.16, wastes generated by mining in the general analysis area would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with the WDEQ/LQD-approved waste disposal plan at the Buckskin Mine. No residual hazardous and solid waste impacts are expected.

As discussed in section 3.17.6, no change in the social setting of Campbell County or the community of Gillette would be anticipated under either action alternative. The Buckskin Mine has been operating for more than 25 years, and the mine and its employees contribute to the

social and economic stability of Campbell County and the City of Gillette. No socioeconomic residual impacts are expected.

Coal mines, including the Buckskin Mine, are under the jurisdiction of the Mine Safety and Health Administration. That agency's mission is to "administer the provisions of the Federal Mine Safety and Health Act of 1977 (Mine Act), as amended by the Mine Improvement and New Emergency Response Act of 2006 (MINER Act), and to enforce compliance with mandatory safety and health standards as a means to eliminate fatal accidents; to reduce the frequency and severity of nonfatal accidents; to minimize health hazards; and to promote improved safety and health conditions in the Nation's mines" (U.S. Department of Labor 2009). While an official health impact assessment is not within the agency's authorization, it does monitor and enforce some of the health and safety standards for mining that are related to these impact assessment issues.

3.18.3 Greenhouse Gas Emissions

Considerable scientific investigation and discussion continue to address the causes of the rise in global mean temperatures and whether a warming trend will continue. This section addresses greenhouse gas (GHG) emissions as specifically related to the Buckskin Mine.

GHGs have been raised as a concern due to the greenhouse effect. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse. Many GHGs occur naturally in the atmosphere, such as carbon dioxide (CO_2), methane (including CBNG), water vapor, ozone (O_3), and nitrous oxide. Other GHGs are synthetic, such as chlorofluorocarbons, hydrofluorocarbons and perfluorocarbons, as well as sulfur hexafluoride.

Although natural GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused equivalent CO_2 (CO_2Eq) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. GHGs are not regulated, but a consensus has become established in the international community that global climate change is occurring and that GHGs may play a role. As with any field of scientific study, uncertainties are associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends (EPA 2008a).

Climatic change analyses are comprised of several factors, including GHG emissions, land use management practices, and the albedo effect (i.e., the cycle of increased temperature of the environment resulting from increased absorption of normally reflected light). It is assumed that existing land and resource conditions in the general analysis area have been and will continue to be affected by climate change under all alternatives. National and regional data that are available

have been referenced, including a recent comprehensive report, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States* (U.S. Climate Change Science Program 2008).

Because the tools necessary to quantify incremental climatic changes associated with these GHG emissions are presently unavailable, the analysis cannot reach conclusions as to the magnitude or significance of the emissions on climate change, or to associate specific actions with the specific climate impacts. The impacts of climate change represent the cumulative impacts of, among other factors, all worldwide GHG and emissions and land use management practices.

As discussed in section 1.3, the BLM does not authorize mining just by issuing a federal coal lease. The WDEQ/LQD, with oversight from the OSM, has regulatory authority in issuing permits to mine coal in Wyoming. However, the BLM considers the impacts of mining coal in this EIS because it is a logical consequence of issuing a maintenance lease to an existing coal mine.

The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is being mined in the Wyoming PRB is used to generate electricity by coal-fired power plants in 36 states. A discussion of emissions and by-products generated by burning coal to produce electricity is included in chapter 4, with a more complete discussion of the status of global climate change and cumulative considerations. That chapter also includes an assessment of cumulative impacts related to GHG emissions under all analyzed alternatives.

As discussed in section 2.2.2, under the currently approved mining plan, which represents the No Action Alternative, Kiewit anticipates that Buckskin Mine would mine its remaining estimated 370.4 million tons of recoverable coal reserves in 14 years at an average annual production rate of approximately 25 million tons. Kiewit estimates that the life of mine would be extended by two years under the Proposed Action and up to six years under Alternative 2. Kiewit estimates that the average annual coal production rate of approximately 25 million tons would continue under either action alternative.

To the extent that emission data were available or could be inferred from representative data, potential GHG emissions have been identified that could result from implementation of either of the action alternatives, as well as emissions that would result from the No Action Alternative. The analysis provides a qualitative measure of the incremental change in GHG emissions resulting from the action and no action alternatives. The analysis also provides a measure of the incremental change resulting from these alternatives in relation to GHG emissions from all current coal mining. Because surface coal mining is already occurring at the Buckskin Mine, additional methane would be released into the atmosphere under any of the alternatives.

This study projects emissions for a typical year of operations at the Buckskin Mine, if additional coal reserves are leased and mined in the general analysis area. Emissions are measured as metric tons of CO_2Eq, a conversion to put any of the various gases emitted (i.e., methane or nitrous oxides) into the equivalent greenhouse effect as compared to CO_2. The completed inventory includes emissions from carbon fuels used in mining operations, electricity used on

site (e.g., facility lighting and operation, lighting to illuminate roads, power for electrically operated equipment, and conveyors), and mining processes (e.g., blasting, methane released from mined coal, and spontaneous combustion). Net carbon sink effects from disturbed and reclaimed lands are considered negligible, as the projected annual stripping and reclamation acreages are roughly equal at 200 acres a year. Not included in this CO_2Eq emissions estimate is rail transport, both on site and to the buyers.

Total CO_2Eq emissions per year from the Buckskin Mine are not expected to increase under either action alternative; maximum annual production would not increase and average strip ratios and haul distances would remain substantially the same as under existing operations. Table 3.18-1 summarizes the annual Buckskin Mine CO_2Eq emissions inventory for nominal and maximum permitted production rates.

Table 3.18-1. Estimated Annual CO_2Eq Emissions at the Buckskin Mine

Source	2008 Actual (25 million tons)	At 30 million metric tons per year	At 42 million metric tons per year
Fuel	94,136	107,379	150,331
Electricity	43,212	49,291	69,007
Mining Process	59,228	67,561	94,585
Total of three sources	196,576	224,231	313,923

CO_2Eq = Equivalent carbon dioxide
Source: Air Quality Data Report, available for viewing at the BLM Wyoming High Plains District Office in Casper, Wyoming.

Conversely, projected CO_2Eq emissions over the life of the mine would increase under either action alternative. Although annual average production and associated annual emissions are not expected to increase, CO_2Eq emissions would be extended by two years beyond the current life-of-mine estimate under the Proposed Action, and up to six years under Alternative 2.

The Center for Climate Strategies estimates that activities in Wyoming will account for approximately 60.3 million tons of gross CO_2Eq emissions in 2010 and 69.4 million tons in 2020 (Center for Climate Strategies 2007). Using those projections, the 2008 Buckskin Mine emissions total (table 3.18-1) represents 0.33% of the 2010 statewide emissions.

As mentioned above, the CO_2Eq emission estimates in table 3.18-1 include projected methane emissions vented from exposed unmined coal. The estimated annual amount of CO_2Eq emissions from vented methane is approximately 53,197 tons, or about 27% of the total Buckskin Mine CO_2Eq emissions. Methane emissions from Wyoming's coal mines in 2010 are projected to be 2.3 million tons of CO_2Eq (Center for Climate Strategies 2007), of which the Buckskin Mine's 2008 methane emissions represent 2.3%. Methane emissions from anthropogenic sources in the U.S. in 2007 totaled 699.9 million metric tons CO_2Eq (U.S. Department of Energy 2008b). Therefore, the estimated 2008 methane emissions vented from recovered coal at the Buckskin Mine constitutes about 0.0076% of the total 2007 U.S. methane emissions from anthropogenic sources.

3.18.4 Carbon Sequestration

Information relative to the carbon sequestration legislation was collected from news coverage posted on the internet and websites for the Wyoming Legislative Services Office, U.S. Department of Energy, and EPA.

Carbon sequestration, the process of carbon capture, separation, and storage or reuse, is being researched as a means to stabilize and reduce concentrations of CO_2 (a greenhouse gas). Direct options for carbon sequestration would involve means to capture CO_2 at the source (e.g., power plant) before it enters the atmosphere coupled with "value-added" sequestration (e.g., use of captured CO_2 in enhanced oil recovery operations). Indirect sequestration would involve means of integrating fossil fuel production and use with terrestrial sequestration and enhanced ocean storage of carbon (U.S. Department of Energy 2007a).

The PRB has geologic formations and producing oil and gas reservoirs that are potential target candidates for both enhanced oil recovery and/or deep geologic sequestration. The current limiting factor is the lack of pipeline infrastructure and economic feasibility for CO_2 transmission and use.

Although one enhanced oil recovery project involving CO_2 injection is underway in the PRB (Salt Creek Field) and another is possibly planned (Highlight Field), no geologic carbon sequestration projects currently exist or are currently planned in the PRB at this time. This may change with the advent of new federal legislation, regulations, and economic incentives, particularly those that may combine enhanced oil recovery and sequestration projects or operations.

Additionally, the EPA, from the perspective of considering CO_2 as a waste, is proposing new federal requirements under the Safe Drinking Water Act for the underground injection of CO_2 for the purpose of long-term underground storage, or geologic sequestration. The regulation is being proposed to ensure protection of underground sources of drinking water from injection-related activities. It is currently expected that the final rulemaking will be completed by 2010. This new rulemaking may result in increased interest in using existing, depleted, deep, oil and gas reservoirs, deep saline formations and/or deep coal seams such as found in the PRB.

3.18.5 Regulatory Compliance, Mitigation, and Monitoring

CO_2, methane, water vapor, O_3, and nitrous oxide are all recognized GHGs. Although these gases are not regulated at this time, the EPA is required by the CAA to regulate emissions of six common "criteria air pollutants," including O_3 and nitrogen dioxide (NO_2), from an air quality standpoint. O_3 and NO_2 emissions are monitored at the south Campbell County air quality monitoring sites; monitoring results are included in the EPA AirExplorer database (EPA 2009a). NO_2 is not a greenhouse gas but it can react with other components of the atmosphere to form O_3. O_3 and NO_2 emissions relating to mining in the general analysis area are discussed in section 3.4. Voluntary mitigation measures to reduce mine-specific GHG emissions currently in place at some PRB mines, including the Buckskin Mine, include the following:

- minimizing blast size to the extent possible to reduce CO_2 and NO_2 emissions;

- using different blends of ammonium nitrate fuel oil and slurries and gels used in coal and overburden blasts to reduce CO_2 and NO_2 emissions;
- reducing fuel consumption by restricting equipment idling times, maintaining equipment (e.g., vehicles, compressors, generators) to improve fuel efficiency, and focusing on high-efficiency engines for replacement, thereby reducing CO_2, NO_2, and N_2O emissions; and
- suppressing in-pit coal fires promptly, thereby reducing CO_2 and NO_2 emissions from coal combustion.

3.19 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action and Alternative 2, the major commitment of resources would be mining and consumption of approximately 54.1 million tons and up to 149.7 million tons of coal, respectively; nearly all of that coal will be used for electrical power generation. CBNG that is not recovered prior to mining would be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBNG to the atmosphere in section 3.18 and in chapter 4). An estimated 1 to 2% of the energy produced would be required to mine the coal; this energy would also be irretrievably lost.

Under the Proposed Action and Alternative 2, the quality and characteristics of topsoil would be irreversibly changed on 419 acres (plus a buffer area to the north of the tract) and up to 1,883 acres (plus a 0.25-mile-wide buffer), respectively, as a result of mining and mine support activities (e.g., topsoil stripping, soil stockpiling). Actual impacts would likely be limited to 618 acres, under Alternative 2, because Kiewit does not anticipate pursuing closure or relocation of county roads necessary to mine additional reserves. Soil formation processes would continue but would be irreversibly altered during mining and related activities. Newly formed soil material would be unlike that in the natural landscape.

Wildlife deaths resulting directly or indirectly from mining operations or associated activity would constitute irreversible and irretrievable losses, though future recruitment into the population would mitigate those losses to some degree.

Loss of human life could occur as a result of mining operations and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming, as determined by the Mine Safety and Health Administration (1997) for the 10-year period from 1987 through 1996, fatal accidents of personnel directly employed at surface coal mines excluding contractors) occur at the rate of 0.003 per 200,000 human-hours worked. Disabling (lost-time) injuries occur at the rate of 1.46 per 200,000 human-hours worked. Any injury or loss of life resulting from mining and related activities would constitute irreversible and irretrievable losses.

Disturbance of all known historic and prehistoric sites in the mined area would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological resources, including Native American resources, would constitute irreversible and irretrievable losses.

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4.0 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

This section summarizes the cumulative impacts that are occurring as a result of existing development in the PRB[1] and considers how those impacts would change if a tract is leased and mined under the Proposed Action or Alternative 2, as well as if other projected development in the area occurs. A table is presented at the end of this chapter (table 4-41) to provide a summary of the magnitude and duration of cumulative impacts in the PRB based on upper and lower estimates for coal production in the region, as described in the following discussion. The Proposed Action and alternatives fall within those projections.

The BLM completed three regional EISs evaluating the potential cumulative impacts of surface coal development in the 1970s and early 1980s (BLM 1974, 1979, and 1981). A draft document for a fourth regional EIS was prepared and released in 1984 (BLM 1984). Since those regional EISs were prepared, BLM has prepared a number of NEPA analyses evaluating coal leasing actions and oil and gas development in the PRB. Each of these NEPA analyses includes an analysis of cumulative impacts in the Wyoming PRB.

Currently, the BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The PRB Coal Review consists of three tasks:

- Task 1 identifies existing resource conditions in the PRB for the baseline year (2003) and, for applicable resources, updates the BLM's 1996 status check for coal development in the PRB.
- Task 2 defines the past and present development activities in the PRB and their associated development levels as of 2003 and develops a forecast of reasonably foreseeable development in the PRB through 2020. The reasonably foreseeable activities fall into three broad categories: coal development (coal mine and coal-related), oil and gas development (conventional oil and gas, CBNG, and major transportation pipelines), and other development, which includes development that is not energy-related as well as other energy-related development.
- Task 3 predicts the cumulative impacts that could be expected to occur to air, water, socioeconomic, and other resources if the development occurs as projected in the forecast developed under Task 2.

A series of reports have been prepared to present the results of the PRB Coal Review task studies. The Task 1, 2, and 3 reports represent components of a technical study of cumulative development in the PRB; they do not evaluate specific proposed projects, but they provide

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[1] Refer to page xiii for a list of abbreviations and acronyms used in this document.

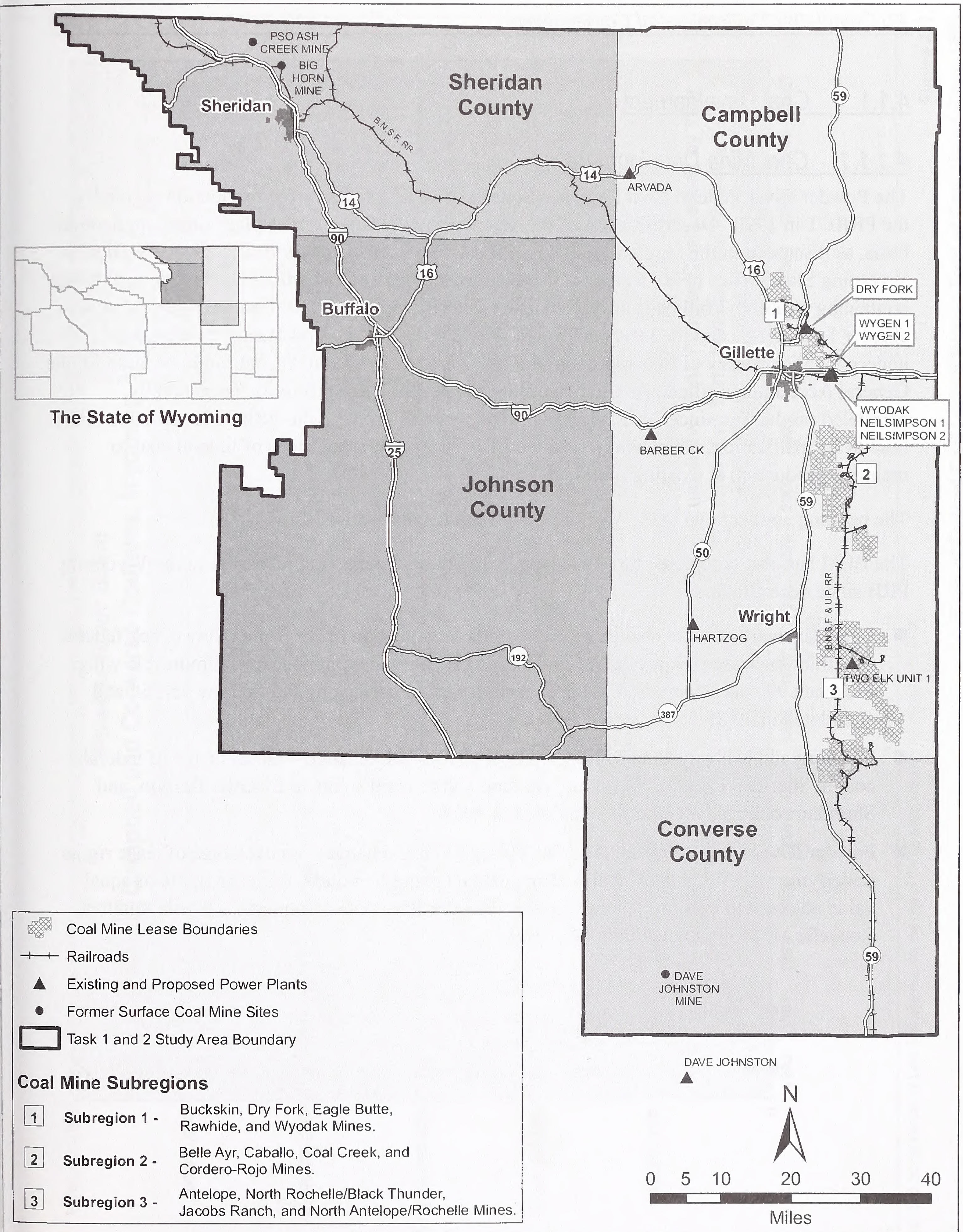
information that BLM is using to evaluate the cumulative impacts that would be expected to occur if specific projects or applications, such as the Proposed Action, are approved. The Task 1 reports, which include air quality conditions, water resources conditions, social/economic conditions, and other resource conditions have been completed. The Task 2 Report has also been completed, as have the Task 3 reports for air quality conditions, social/economic conditions, and other resource conditions. The Task 3 evaluation of water resource conditions is in progress. The information in these reports is summarized later in this chapter, and the completed reports are available for viewing at the BLM offices in Casper and Cheyenne and on the Wyoming BLM at: http://www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal/prbdocs.html.

The PRB includes portions of northeastern Wyoming and southeastern Montana. The Wyoming portion of the PRB is the primary focus of the PRB Coal Review reports. The Montana portion of the PRB is included in the Task 2 Report and in the Task 1 and 3 air resources studies. For the majority of resources in the Task 1 reports and for the Task 2 Report, the Wyoming portion of the PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson counties outside of the Bighorn National Forest, and the northern portion of Converse County (map 4-1). For some components of the Task 2 Report and for the Task 1 and 3 air resource studies, the Montana PRB Coal Review study area includes portions of Big Horn, Custer, Powder River, Rosebud, and Treasure counties. For several resources, the Task 1 and Task 3 study areas include only potentially affected portions of the Wyoming PRB Coal Review study area; for other resources, the study area extends outside of Wyoming and Montana because the impacts would extend beyond the PRB. For example, the groundwater drawdown is evaluated in the area surrounding and extending west of the mines, because that is the area where surface coal mining operations would impact groundwater resources; but air quality impacts are evaluated over a multi-state area because they would be expected to extend beyond the PRB.

Section 4.1 summarizes the information presented in the PRB Coal Review Task 1 and Task 2 reports. Section 4.2 summarizes the predicted cumulative impacts on air, water, socioeconomic, and other resources presented in the PRB Coal Review Task 3 reports.

4.1 Past, Present, and Reasonably Foreseeable Development

Past, present, and reasonably foreseeable development in the Wyoming PRB are considered in the Task 1 and Task 2 reports for the PRB Coal Review. The Task 1 reports describe the existing situation as of the end of 2003, which reflects the past and present levels of development. The Task 2 Report defines the past and present development activities in the PRB as of the end of 2003 and projects reasonably foreseeable development in the Wyoming PRB through 2020. When available, 2007 development information is included.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 4-1

Wyoming Study Area for PRB Coal Review Studies Evaluating Current and Projected Levels of Development

4.1.1 Coal Development

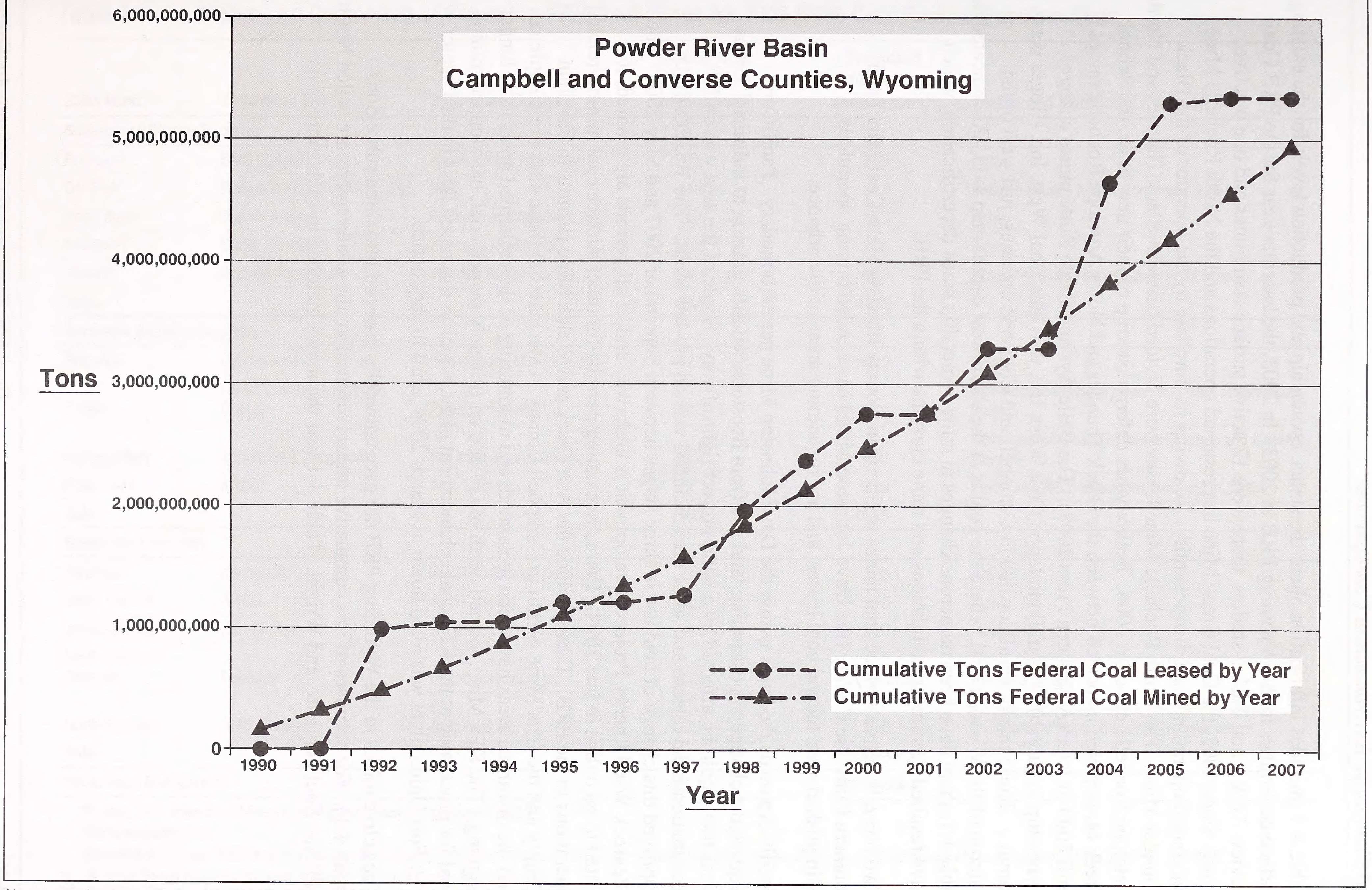
4.1.1.1 Coal Mine Development

The Powder River Federal Coal Region was decertified as a federal coal production region by the PRRCT in 1990. Decertification of the region allows leasing to take place on an application basis, as discussed in the regulations at 43 CFR 3425.1-5. Between 1990 and 2008, the BLM's Wyoming State Office held 25 competitive coal lease sales and issued 19 new federal coal leases containing almost 5.7 billion tons of coal using the LBA process. The lease sales are listed in chapter 1, table 1-1, and the leased tracts are shown on map 1-1. This leasing process has undergone the scrutiny of two appeals to the Interior Board of Land Appeals and one audit by the General Accounting Office. As can be seen on figure 4-1, leasing activity has generally paralleled production since decertification. This is consistent with the PRRCT's objective at the time of decertification, which was to use the LBA process to lease tracts of federal coal to maintain production at existing mines.

The pending applications in the Wyoming PRB are listed in table 1-2.

The BLM has also completed three exchanges involving federal coal resources in the Wyoming PRB since decertification:

- Belco Exchange – an exchange of lease rights for a portion of the former Hay Creek federal coal tract for lease rights to coal near Buffalo, Wyoming, which became unmineable when Interstate 90 was constructed. This exchange was authorized by Public Law 95-554 and completed in 2000.
- Pittsburg and Midway Coal Mining Company (P&M) Exchange – an exchange of federal coal in Sheridan County, Wyoming, for land and mineral rights in Lincoln, Carbon, and Sheridan counties, Wyoming, completed in 2004.
- Powder River Coal Company Alluvial Valley Floor Exchange – an exchange of lease rights underlying an AVF at the Caballo Mine, which cannot be mined, for lease rights of equal value adjacent to existing federal leases at Powder River Coal Company's North Antelope Rochelle Mine, completed in 2006.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 4-1
Tons of Federal Coal Leased Versus Tons of Coal Mined Since 1990

Table 4-1 provides information about the status, ownership and production levels for the existing surface coal mines in the Wyoming PRB in 2003. In 2003, the baseline year for the PRB Coal Review Task 1 and Task 2 studies, there were 12 active surface coal mines and one inactive mine. Since 2003, the Coal Creek Mine has resumed operations and the North Rochelle Mine has ceased operation (as a distinct entity) following its purchase by the operator of the Black Thunder Mine. The North Rochelle Mine leases were divided between Black Thunder and North Antelope Rochelle mines in 2006. Peabody has deferred startup of their new mine, the School Creek Mine which is located between the Black Thunder and North Antelope Rochelle mines, until 2009 or later (Associated Press 2008). The Belle Ayr and Eagle Butte mines changed ownership in July 2009 from Foundation Coal West, Inc. to Alpha Coal West, Inc. (Boger pers. comm.). These mines are all located in Campbell and Converse counties, just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth (map 1-1). As indicated in table 4-1, there have been numerous changes in mine ownership since decertification, which have resulted in mine consolidations and mine closings within the PRB.

Two recently active surface coal mines in Sheridan County (the Big Horn Coal Mine) and southern Converse County (the Dave Johnston Mine) have ended mining operations, relinquished their federal coal leases, and are reclaiming areas of disturbance.

PacifiCorp owns the lands within the Dave Johnston Mine permit boundary. PacifiCorp requested a change in postmining land use from livestock/wildlife grazing to industrial for the areas that would be affected by a wind project right-of-way. Some of the area was on full reclamation bond release and some area included was on pre-law lands. The WDEQ/LQD approved this change of land use in three stages between September 2007 and May 2008. The Glenrock Wind Energy Project development is underway and, if all permits are granted, it is slated to go online in late 2009. There are existing permits for other surface coal mining-related operations in the PRB. These include the Ash Creek and Welch Mine permits in Sheridan County and the Izita Mine permit in Campbell County. Operations at these sites are completed and the disturbed areas have been reclaimed, and monitoring of the reclaimed areas is no longer ongoing. The KFx Mine, located north of Gillette on privately owned coal, has stopped mining coal for processing at the KFx coal enhancement plant, which is discussed later in the chapter. The Fort Union plant was idled down in March 2008, until further notice.

The active mines in the Wyoming PRB are geographically grouped into three subregions (map 4-1). For purposes of this cumulative impact discussion, these subregions are called North Gillette, South Gillette, and Wright. Table 4-1 lists the mines included in each subregion.

Table 4-1. Status and Ownership of Wyoming PRB Coal Mines for 2003 (PRB Coal Review Baseline Year)

2003 Mine	1994 Mine Owner	2007 Mine Owner	Actual Coal Production (million tons)[1]	Permitted Production Level (million tons)[2]	Status and Additional Comments
SUBREGION 1 (NORTH GILLETTE)					
Buckskin	SMC (Zeigler)	Kiewit Mining Properties	17.5	27.5	Active
Dry Fork	Phillips/WFA & Fort Union Ltd	WFA	4.4	24.4	Active (includes former Fort Union Mine)
Eagle Butte	Cyprus-Amax	Foundation Coal West, Inc.[3]	24.5	35.0	Active
Rawhide	Carter (Exxon)	Peabody Holding Co.	3.6	24.0	Active
Wyodak	Wyodak Resources	Wyodak Resources	4.8	12.0	Active (includes former Clovis Point Mine)
Total			**54.8**	**122.9**	
SUBREGION 2 (SOUTH GILLETTE)					
Belle Ayr	Cyprus-Amax	Foundation Coal West, Inc.[3]	17.9	35.0	Active
Caballo	Carter (Exxon) & Western Energy	Peabody Holding Co.	22.7	40.0	Active (includes Rocky Butte and West Rocky Butte leases)
Cordero Rojo	Kennecott & Drummond	Rio Tinto Energy America[4]	36.1	65.0	Active (consolidation of former Cordero and Caballo Rojo Mines)
Coal Creek	ARCO	Arch Coal Inc.	0	25.0	Inactive in 2003, operations resumed in 2006
Total			**76.7**	**165.0**	
SUBREGION 3 (WRIGHT)					
Antelope	Kennecott	Rio Tinto Energy America[4]	29.5	32.0	Active
Black Thunder	ARCO	Arch Coal Inc.	62.6	90.0	Active
Jacobs Ranch	Kerr-McGee	Rio Tinto Energy America[4]	36.0	55.0	Active
North Antelope Rochelle	Peabody	Peabody Holding Co.	80.1	85.0-105.0	Active (consolidation of former North Antelope and Rochelle Mines)
North Rochelle	SMC (Zeigler)	Arch Coal Inc.	23.9	35.0	Inactive since 2005, leases split between Black Thunder and North Antelope Rochelle Mines
Total			**232.1**	**297.0-317.0**	
TOTAL FOR 3 MINE GROUPS			**363.6**	**584.9-604.9**	

1 Wyoming State Inspector of Mines (Wyoming Department of Employment 2003)

2 WDEQ permitting levels

3 Ownership of the Eagle Butte Mine and Belle Ayr Mine changed from Foundation Coal West, Inc., to Alpha Coal West, Inc., as of July 31, 2009. Notification of ownership submitted to BLM in August 2009.

4 Kennecott Energy Company changed its name to Rio Tinto Energy America in 2006.

A fourth subregion includes former and proposed mines in Sheridan County, Wyoming, and existing mines just north of Sheridan County, in Montana. There are currently no active mines in the Wyoming portion of the fourth subregion. However, the PRB Coal Review Task 2 Report projected that a new mine would be developed by P&M near Sheridan by 2010. In April, 2007, P&M and CONSOL Energy Inc. announced that they have formed a new company, Youngs Creek Mining Company, LLC, and entered into a joint agreement to develop a new mine in Wyoming north of Sheridan (*Reuters* 2007). According to the announcement, engineering, environmental, and permitting work are in progress, but actual mine construction will not start until the joint venture has enough coal sales under contract to justify the investment. The coal reserves included in this project are privately owned.

The surface coal mines listed in table 4-1 currently produce over 96% of the coal produced in Wyoming each year. Since 1989, coal production in the PRB has increased by an average of 6% per year. The increasing production is primarily due to increasing sales of low-sulfur, low-cost PRB coal to electric utilities who must comply with the phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97% of Wyoming's coal sales. In the baseline year for the PRB Coal Review (2003), more than 35% of the coal mined in the U.S. came from the Wyoming PRB. By 2007, that amount had increased to about 38% (U.S. Department of Energy 2008).

The BLM estimates that the surface coal mines listed in table 4-1 currently have about 125,180 acres of federal coal leased in Campbell and Converse counties. This represents approximately 4.1% of Campbell County, where the majority of the leases are located.

Task 2 of the PRB Coal Review projected coal development into the future for the years 2010, 2015, and 2020. Due to the variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed to bracket the most likely foreseeable regional coal production level. The basis for the projected production levels included:

1. analysis of historic PRB production levels in comparison to the gross domestic product and national coal demand;
2. analysis of PRB coal market forecasts that model the impact of gross domestic product growth, potential regulatory changes affecting coal-fired power plants, and mining and transportation costs on PRB coal demand;
3. availability, projected production cost, and quality of future mine-specific coal reserves within the PRB region; and
4. availability of adequate infrastructure for coal transportation.

The projected upper and lower production levels subsequently were allocated to the Wyoming PRB subregions, discussed above, and to individual mines based on past market shares. Individual mine production levels were reviewed relative to potential future production constraints (e.g., loadout capacities), permitted production levels, mining costs, and coal quality.

Then the projected future production was aggregated on a subregion basis. The actual 2003 production level, the 2007 production level as a reference point, and the two projected coal production scenarios for 2010, 2015, and 2020 are shown in figure 4-2 and tables 4-2 and 4-3.

Tables 4-2 and 4-3 also show the cumulative coal mining disturbance as of the baseline year and the cumulative coal mine disturbance projected for the future years for the upper and lower coal production scenarios.

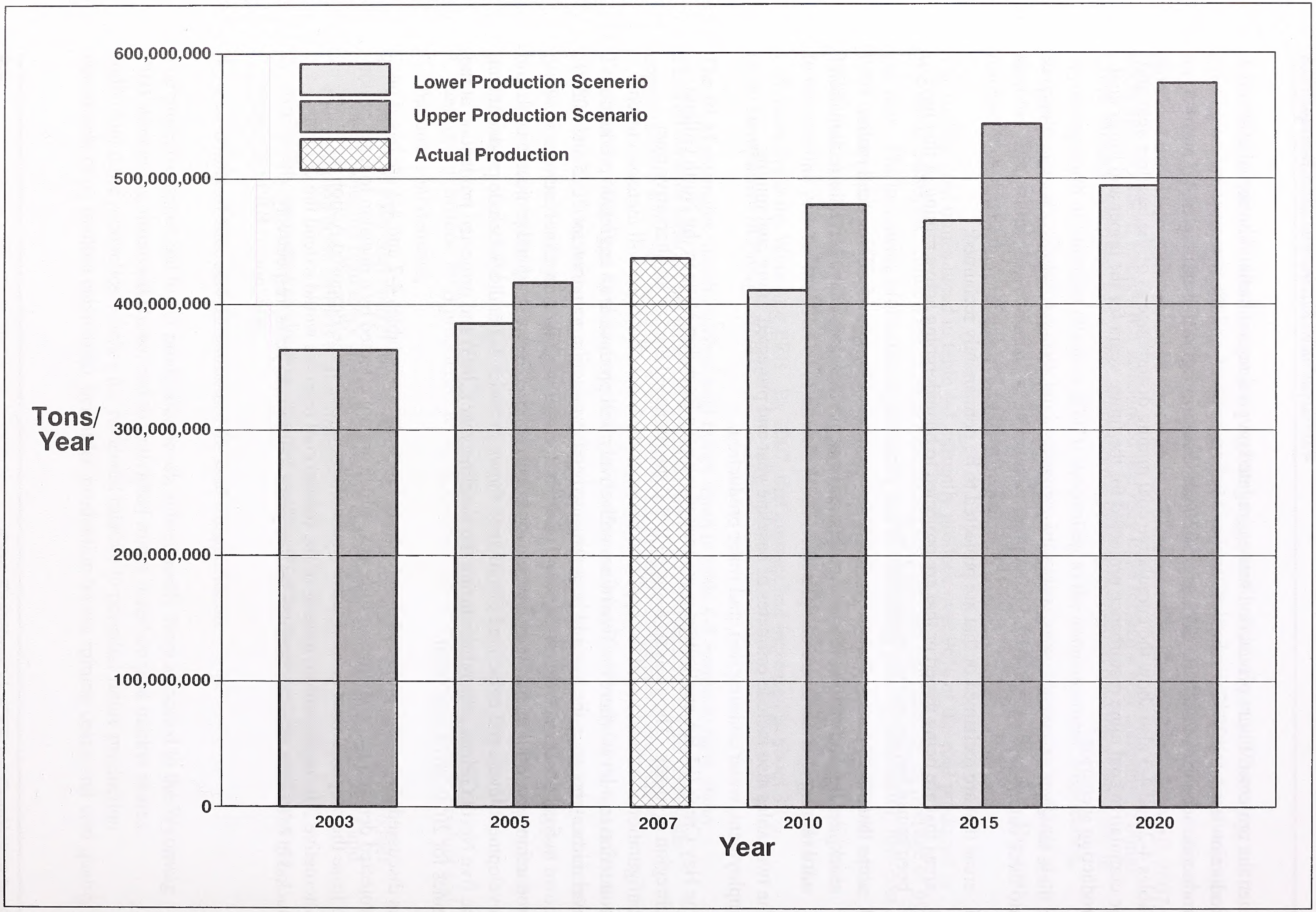
In these tables, the baseline year and cumulative projected disturbance areas are broken down into three categories:

- areas that are reclaimed or that are projected to be permanently reclaimed;
- areas that are being mined or that are projected to be undergoing active mining or that have been mined but are not yet reclaimed; and
- areas that already are or that are projected to be occupied by mine facilities, haul roads, stockpiles, and other long-term structures, and that are therefore unavailable for reclamation until mining operations are completed.

The two tables also include estimates of baseline year and projected future coal mining employment, water consumption, and water production.

The Hay Creek II LBA application is associated with the Buckskin Mine in the North Gillette subregion of mines. The analysis assumes that if the proposed tract or an alternative tract configuration is offered and if the applicant becomes the lessee, the mine will increase current production to a level where the five mines collectively will produce at an aggregate production level midway between the low and high projected coal production scenarios for 2015 and 2020 shown in figure 4-2 and tables 4-2 and 4-3; Kiewit does not anticipate an actual increase in production as a result of acquiring a new maintenance tract. The existing and projected coal development levels and associated disturbance shown in tables 4-2 and 4-3 include production at the five North Gillette area mines during the baseline year (2003) and projected production at the mines for 2010, 2015, and 2020.

As discussed above, the projected development levels shown in tables 4-2 and 4-3 are based on projected demand and coal market forecasts, which are not affected by a decision to lease or not to lease the proposed tract or alternative tract configuration. If the Proposed Action or Alternative 2 is implemented, mining of the federal coal reserves would extend the current Buckskin Mine life-of-mine estimate by two years or up to six years, respectively.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 4-2

Projected Total Coal Production from Campbell and Converse Counties under the Lower and Upper Production Scenarios

Table 4-2. Baseline Year and Projected Wyoming PRB Coal Mine Development, Lower Coal Production Scenario

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-feet)
BASELINE YEAR (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	231	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	363	68,794	21,238	23,459	24,097	5,010	2,640	4,254
REASONABLY FORESEEABLE DEVELOPMENT FOR 2010								
North Gillette Subregion	62	15,231	5,004	3,968	6,260	787	441	505
South Gillette Subregion	95	28,021	12,183	6,830	9,008	1,323	656	2,072
Wright Subregion	254	55,410	27,751	16,588	11,070	3,153	1,874	4,354
Total for 2010	411	98,662	44,938	27,386	26,338	5,263	2,971	6,931
REASONABLY FORESEEABLE DEVELOPMENT FOR 2015								
North Gillette Subregion	74	17,457	6,654	4,202	6,601	830	543	505
South Gillette Subregion	112	32,356	15,683	7,314	9,359	1,369	764	2,072
Wright Subregion	281	67,423	38,851	16,983	11,589	3,186	2,077	4,354
Total for 2015	467	117,236	61,188	28,499	27,549	5,405	3,384	6,931
REASONABLY FORESEEABLE DEVELOPMENT FOR 2020								
North Gillette Subregion	78	19,729	8,429	4,350	6,950	840	569	505
South Gillette Subregion	126	36,994	19,683	7,589	9,723	1,476	845	2,072
Wright Subregion	291	80,720	51,351	17,243	12,124	3,215	2,157	4,354
Total for 2020	495	137,443	79,463	29,182	28,797	5,531	3,571	6,931

mmgpy = million gallons per year

Note: Area unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.

Source: PRB Coal Review Task 2 Report (BLM 2005b)

Table 4-3. Baseline Year and Projected Wyoming PRB Coal Mine Development, Upper Coal Production Scenario

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-feet)
BASELINE YEAR (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	232	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	363	68,794	21,238	23,459	24,097	5,010	2,640	4,254
REASONABLY FORESEEABLE DEVELOPMENT FOR 2010								
North Gillette Subregion	78	15,911	5,404	4,217	6,290	811	570	505
South Gillette Subregion	117	29,279	13,416	7,536	8,328	1,375	807	2,072
Wright Subregion	284	57,258	27,951	18,236	11,070	3,153	2,101	4,354
Total for 2010	479	102,448	46,771	29,989	25,688	5,339	3,478	6,931
REASONABLY FORESEEABLE DEVELOPMENT FOR 2015								
North Gillette Subregion	104	18,490	7,329	4,500	6,660	905	785	505
South Gillette Subregion	138	35,624	18,616	8,248	8,760	1,431	952	2,072
Wright Subregion	301	70,431	39,451	19,391	11,589	3,186	1,834	4,354
Total for 2015	543	124,545	65,396	32,139	27,009	5,522	3,571	6,931
REASONABLY FORESEEABLE DEVELOPMENT FOR 2020								
North Gillette Subregion	121	21,311	9,529	4,766	7,013	1,019	935	505
South Gillette Subregion	148	42,981	25,016	8,758	9,206	1,444	1,018	2,072
Wright Subregion	307	84,797	51,651	21,021	12,124	3,215	2,279	4,354
Total for 2020	576	149,089	86,196	34,545	28,345	5,678	4,232	6,931

mmgpy = million gallons per year.

[1] Area Unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.

Source: PRB Coal Review Task 2 Report (BLM 2005b)

As discussed in sections 1.1.3.1, Kiewit estimates that the existing Buckskin Mine had approximately 344.3 million tons of recoverable coal reserves at the end of 2008. Overall, the mine had produced a total of 339.8 million tons of coal as of December 2008, with annual production averaging 20.6 million tons over the previous six years. The mine's current air quality permit as approved by the WDEQ/AQD allows mining of up to 42 million tons of coal per year. If the mine produces coal at the projected estimate of 25 million tons per year, the remaining recoverable reserves would be depleted in less than 14 years (2022). If the mine increases production to the permitted level, the remaining recoverable reserves at the Buckskin Mine would be depleted in about 8.8 years (2016). Kiewit estimates that the proposed tract includes approximately 54.1 million tons of recoverable coal. Based on that estimate, acquisition of the proposed tract would increase the recoverable reserves at the Buckskin Mine by almost 14.6%. At the estimated future production level (25 million tons per year), mine life would be extended by over two years. However, if production levels increase to the currently permitted level (42 million tons per year) or if the WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly.

4.1.1.2 Coal-Related Development

Coal-related development as defined for this analysis includes railroads, coal-fired power plants, major (230-kilovolt) transmission lines, and coal technology projects. Table 4-4 summarizes the estimated disturbance associated with coal-related development activities for the baseline year and the projected disturbance through 2020. The subsequent paragraphs summarize the existing coal-related development in the Wyoming PRB and the reasonably foreseeable development considered in the PRB Coal Review.

Table 4-4. Baseline Year and Projected Wyoming PRB Coal-Related Development Scenario

Coal-Related Disturbance (acres)	2003	2010	2015	2020
	4,891	4,966	5,911	5,911

Source: PRB Coal Review Task 2 Report (BLM 2005b)

Coal Transportation

As discussed above, electric utilities account for about 97% of Wyoming's coal sales. Most of the coal sold to electric utilities is transported to power plants by rail. A small part, about 2% in 2007, of national coal production is exported abroad, but data are not published as to where this export coal is produced. A joint BNSF and UP rail line serves the coal mines in the Wright and South Gillette subregions. For the baseline year of 2003, the existing capacity of the line was estimated at approximately 350 million tons per year. For that same year, the existing capacity of the BNSF line, which services the North Gillette subregion, was estimated at 250 million tons per year. Expansion work completed in 2008 increased the capacity to approximately 450 million tons per year, and plans have been announced to raise BNSF line capacity to 500 million tons per year by 2012 (BNSF 2008; CANAC 2007).

The PRB Coal Review projected that two coal transportation projects would be developed prior to 2020 in Wyoming: expansion of the BNSF and UP rail facilities south of Gillette and the construction of the Dakota, Minnesota and Eastern Railroad Corporation (DM&E) rail line in Wyoming and South Dakota. A third project proposed by the Tongue River Rail Company would be built between Decker and Miles City, Montana.

BNSF and UP have completed work to improve sections of the existing joint rail line and had increased capacity from 350 million tons per year to 450 million tons per year by 2008 with plans to improve additional sections of the existing joint rail line and to further increase capacity to 500 million tons per year by 2012. This work includes construction of third and fourth main line track segments where needed. The increased capacity would accommodate the projected upper and lower production rates at the southern mines, which are projected to produce 439 million tons per year and 455 million tons per year by 2020. The remaining planned expansion projects are considered highly likely to occur.

The proposed DM&E rail line would include new rail construction in South Dakota and Wyoming (approximately 15 and 265 miles, respectively) and 600 miles of rail line rehabilitation in South Dakota and Minnesota. Approximately 78 miles of the new rail construction would occur in the PRB study area, where the project would provide new rail spur services to the mines in the South Gillette and Wright subregions. The Surface Transportation Board released a final supplemental EIS for this project on December 30, 2005, and granted final approval to construct the rail line on February 15, 2006. The supplemental EIS, which addressed issues that were successfully appealed after an EIS was completed in 2001, was also appealed. The U.S. Court of Appeals for the Eighth Circuit upheld the appeal of the supplemental EIS in December 2006. In 2007, Canadian Pacific Railway acquired DM&E and plans to integrate DM&E's operations into Canadian Pacific Railway's operations. Those plans were approved by the Surface Transportation Board on September 30, 2008 (Surface Transportation Board 2008). The expansion into the PRB would require a substantial financial commitment, and Canadian Pacific is concentrating on the acquisition of DM&E before making a decision on the expansion project.

The Surface Transportation Board recently announced approval of the final stretch of the rail line proposed by the Tongue River Railroad Company. The company must acquire necessary federal and state permits and ROWs through private and public property before constructing the line. If it is constructed, it would provide a shorter route for some of the mines in the North Gillette subregion, which ship coal on the existing BNSF rail line (Brown 2007).

For the purposes of the PRB Coal Review, it was projected that the DM&E line would be constructed when the total rail haulage requirement from the eastern Wyoming PRB reaches 450 to 500 million tons per year and would potentially be operational by 2015. The construction of this rail line is considered moderately likely to occur. The PRB Coal Review assigned a low likelihood of development by 2010 under the upper coal production scenario, and projected the construction of the Tongue River Railroad Company line would not occur unless the Otter Creek Mine is developed. In July 2008, the Montana Department of Natural Resources and Conservation initiated an appraisal of two Otter Creek lease tracts on state lands to determine the

fair market value that the state should accept from a qualified bidder. The appraisal was completed in January 2009, but no leasing action has occurred yet.

Electric Power Generation

Five coal-fired power plants are in the Wyoming PRB study area analyzed in Tasks 1 and 2 (map 4-1). Black Hills Power Corporation owns and operates the Neal Simpson Units 1 and 2 (21.7-megawatts [MW] and 80-MW, respectively), Wygen I and II (80-MW and 95-MW, respectively), and Wyodak (330-MW) power plants, all of which are located approximately 5 miles east of Gillette, Wyoming. Pacific Power and Light's Dave Johnston Power Plant is located near Glenrock, Wyoming outside of, but adjacent to, the study area.

Three separate interconnected gas-fired power plants (Hartzog, Arvada, and Barber Creek) are also located near Gillette, Wyoming (map 4-1). Each contains three separate 5-MW-rated turbines that provide electric power to Basin Electric and its customers. In winter, the maximum capacity can reach 22.6-MW from each site. All units are in operating condition, although they do not operate at maximum capacity.

Several additional power plants are projected to be built prior to 2020. The PRB Coal Review assumed that proposed coal-fired power plants that plan to initiate operation by 2010 would have to have been undergoing air quality permit review by 2003 in order to obtain the required construction permits and complete construction by 2010. The following two identified projects are considered likely for development by 2010:

- North American Power Group has permitted a coal-fired power plant (Two Elk Unit 1) at a 40-acre site located approximately 15 miles southeast of Wright, Wyoming. As originally permitted, the project also would include installation of a gas fired turbine. The unit would be dry-cooled, requiring very little water. The state has approved several hundred million dollars in tax-exempt bonds for the power plant. North American Power Group is completing financing for the remaining cost of the plant. The company recently announced that it has signed a transmissions agreement with Pacificorp and is planning to have the 320-MW plant in operation by October 2011 (Associated Press 2007b, Gartrell 2007b). The air quality permit was originally issued in August 2002, then revoked temporarily and restored by the WDEQ in 2007. In 2008, the Wyoming Environmental Quality Council denied a request by the Sierra Club for a new hearing on the air quality permit allowing construction of the facility. The Sierra Club filed a lawsuit in district court in Cheyenne to reverse the WDEQ decision (Brown 2008).

- Basin Electric Power Cooperative obtained permits from the Wyoming Industrial Siting Council in June 2006, and the WDEQ/AQD in October 2007, to construct and operate the Dry Fork Station Power Plant. As proposed, the Dry Fork Station would be a coal-based, mine-mouth 385-MW power plant located near the Dry Fork Mine, north of Gillette, Wyoming. The issuance of the air quality permit allowed construction of the plant to start in November 2007. In late October 2007, an appeal was filed regarding the air quality permit issued by the WDEQ. The Wyoming Environmental Quality Council denied requests to suspend construction. After due process, on November 20, 2008, the council approved

orders to dismiss the issues before it and terminated the appeal. The orders were signed on December 12, 2008. The protestors announced intent to appeal in Wyoming District Court. Basin Electric estimates that the plant will be operational by 2011 (WDEQ/ISD 2007). At the time of the PRB Coal Review study, it was estimated that 1.2 million tons of coal per year would be required to fuel the facility. Construction of this facility is underway, and operation is expected to begin as scheduled.

The PRB Coal Review assumes that, under the upper coal production scenario, a maximum of one additional 700-MW coal-fired power plant would be constructed by 2020 in the Gillette area or near one or more of the operating coal mines. North American Power Group submitted an application in September 2007 for a 750-MW coal-fired power plant, Two Elk 2, to be located at the same site as the proposed Two Elk plant, which is discussed above. Black Hills Power Corporation has also announced plans to construct the Wygen III power plant, sized at 100MW, which is planned to be similar in design to the Wygen II plant. As of November 2008, the project was on schedule. The air quality permit for this facility was issued in March 2007 and construction started in 2008 (SourceWatch 2008). The study assumes that all existing power plants in the PRB region would remain operational through 2020.

Transmission Lines

Major transmission lines in the Wyoming PRB study area that support the regional distribution system are associated with the Dave Johnston Power Plant located near Glenrock, Wyoming, and the power plants operated by Black Hills Power Corporation, which are located east of Gillette. These 230-kilovolt transmission lines have been in place for several years, and their associated permanent disturbance is minimal. Distribution power lines associated with conventional oil and gas and CBNG development also occur within the study area. For the PRB Coal Review, these lines were included by factoring them in proportionally on a per-well basis.

The PRB Coal Review estimated that by 2020 four major transmission lines would be constructed. Markets would dictate the size and location of such facilities, and these are not known as of this time. Because transmission lines are a necessary supporting infrastructure for power generating facilities to provide connection to the grid, the PRB Coal Review assumes they would be required as part of the overall system development for the proposed power plants discussed earlier. Six specific proposals for these transmission lines have been identified. Information is insufficient to analyze or assign likelihood of development by 2020.

The governors of California, Nevada, Utah, and Wyoming entered into a memorandum of understanding to encourage development of a high voltage power transmission line, the Frontier Line, connecting those states in April 2005. Since that time, no specific plans have been announced as to the location or timing of the Frontier Line. The 345-kilovolt Wyoming-Colorado Intertie as well as the Trans West and Gateway West and South projects have been proposed in Wyoming to move power from Wyoming to Idaho and Nevada and other western U.S. load demand areas (Hodges 2007). The TransWestern Express proposes to move electric power from Wyoming to Arizona through Colorado or Utah. The High Plains Express proposes to move power from Wyoming to New Mexico and Arizona.

Coal Conversion Technology

With rising energy prices, there has been considerable interest in either enhancing the quality of PRB coal and/or converting the coal to other fuels. Test facilities were previously constructed by KFx at the Fort Union Mine (now part of the Dry Fork Mine), by AMAX (now Alpha Coal West, Inc.) at the Belle Ayr Mine, and by ENCOAL at the Buckskin Mine. No commercial production has occurred, and these facilities have either been dismantled or are no longer in use. Although several coal conversion projects have been proposed, as discussed below, only one (the KFx Coal Beneficiation Project) was considered to have a high enough likelihood of proceeding to include it in the PRB Coal Review, based on its status and available information.

The KFx (now Evergreen Energy) coal beneficiation plant, located near the Dry Fork Mine, north of Gillette, was operational but did not reach full capacity. KFx reported making its first production run and shipping coal to two customers for test burns in late December 2005. In August 2006, KFx reported that a trainload of enhanced coal had been loaded and sent to a customer in Ohio. The commercially viable product was produced through 2007 until the plant was idled down in 2008. It was predicted that the plant would eventually produce approximately 750,000 tons of enhanced coal per year. This operation had a high likelihood of proceeding with production given the technology being used and the forecast market conditions in the PRB. Evergreen Energy Inc. and its strategic partner, Bechtel Power Cooperation, have decided to improve the plant design and relocate the operation to a different area with a greater market (Evergreen Energy 2009). The company has suggested that up to five additional units will be built, some perhaps in the PRB, but the likelihood for development of additional units is not known. As a result, the potential development of additional units was not analyzed in the PRB Coal Review.

The following coal conversion projects have been proposed, but were not included in the PRB Coal Review analysis because the likelihood of their occurrence was not known when the coal review analysis was conducted:

- Medicine Bow Fuel and Power, a subsidiary of DKRW Advanced Fuels, LLC, has announced that it plans to build a coal-to-liquids plant with an in-service year of 2013 in northern Carbon County, Wyoming. GE Energy and Rentech Clean Energy Solutions are also involved in the project, which would obtain coal from Saddleback Hills Mine facility. Both the plant and mine are located outside of the PRB. The primary product would be ultra-low-sulfur diesel fuel produced from sub-bituminous coal. The company is in the process of permitting the plant and expects to begin initial site work in 2010, with completion planned for 2011 (Hodges 2007; DKRW Advanced Fuels 2008).
- LUCA Technologies Inc. has developed a method of producing biogenetic methane through methanogenisis. This process uses a group of predominantly anaerobic microorganisms that metabolize the complex organic molecules in hydrocarbon deposits and produce the gas as a waste product. The company transforms uneconomically producing CBNG wells and uses the existing infrastructure for its coal conversion and methane production operations, which are handled by their directly owned subsidiary, Patriot Energy Resources. The company has

completed their test project near Sheridan, Wyoming and has begun operations using a chemical nutrient used to feed existing anaerobic microbacteria currently residing in the PRB coal seams. These microbacterial communities are currently capable of producing up to 30 million cubic feet per day of methane after nutrients are provided. The amount of coal converted through methanogenisis is less than 1% at the current level of technology. The future rate of the technological development and production of methane using microbacteria is unknown at this time but it is expected that, with continued success and public demand for either methane, hydrogen, or other biological metabolic byproducts of the microbial consortia, such operations could remain in place for the foreseeable future and produce some product until the coal has been converted into carbon and other remnant components of PRB coal such as ash and sulfur. LUCA is projecting the possibility of developing the same technology to produce methane and other products from non-coal hydrocarbon substrates and deposits (DeBruyn pers.comm.).Several groups, including the Wyoming Business Council, Campbell County Economic Development Corporation, and Converse Area New Development Organization are actively pursuing coal gasification development projects. Specifically, the Converse Area New Development Organization is pursuing the development of coal gasification leading to production of pure hydrogen with CO_2 as a by-product within five to eight years. While there appears to be substantial interest in these opportunities, it is unknown whether large-scale operations would be developed within the 2010 to 2020 timeframe, given permitting, engineering, and construction time requirements. When the PRB Coal Review was prepared, a project proponent with adequate financing to pursue a project that would use PRB coal had not been identified, and one has not been identified since.

Table 4-5 is a summary of past, present, and reasonably foreseeable coal mines, coal-related facilities, coal production, coal mine employment, and coal and coal-related disturbance in the Wyoming PRB.

Table 4-5. Past, Present, and Projected Wyoming PRB Coal Mine and Coal-Related Development Scenario

Year	Coal Production (mmtpy)	Number of Active Coal Mines[1]	Number of Active Power Plants	Number of Active Coal Conversion Facilities[2]	Direct Coal Mine Employment	Total Coal Disturbance (acres)[3]
PAST AND PRESENT						
1990	163	18	3	1	2,862	na
1995	247	19	4	1	3,177	na
2000	323	12	4	2	3,335	na
2003	363	12	4	0	5,010	73,685
PROJECTED DEVELOPMENT - LOWER COAL PRODUCTION SCENARIO						
2010	411	131	7	12	5,263	103,628
2015	467	131	7	12	5,405	123,147
2020	495	131	7	12	5,531	143,354
PROJECTED DEVELOPMENT - UPPER COAL PRODUCTION SCENARIO						
2010	479	131	7	12	5,339	107,414
2015	543	131	7	12	5,522	130,456
2020	576	131	8	12	5,678	155,000

mmtpy = million tons per year.

1 Mines have consolidated and may do so in the future. Also, new mines may be permitted to better access the coal reserves projected for mining by 2020.

2 Several coal conversion facilities are currently being evaluated; however, only one has the likelihood of future development can be assessed.

3 Disturbance area includes coal mine and coal-related disturbance areas.

Source: Annual Report of the Wyoming State Mine Inspector (Wyoming Department of Employment 1990, 1995, 2000, and 2003) and PRB Coal Review Task 2 Report (BLM 2005b)

4.1.2 Oil and Gas Development

The following information on existing conventional and CBNG development is summarized from the PRB Coal Review Task 2 Report (BLM 2005b). The information reported is for 2003, which was the baseline year for the coal review.

4.1.2.1 Conventional Oil and Gas

Conventional oil and gas development includes all non-CBNG development activity. Approximately 1,500 conventional oil and gas wells, including producing, non-producing, and injection wells, were drilled between 1990 and 2003 (IHS 2004) in the PRB Coal Review Task 2 study area. Of those, 60% were development wells drilled in established producing areas. The remaining 40% were classified as wildcat wells, which are wells that are drilled in non-producing areas or drilled to evaluate untested prospective zones in producing areas. Approximately 75% of the wildcat wells were plugged and abandoned. By 2003, the successful new field wildcat wells had resulted in the discovery of 61 new fields that produced 719,000 barrels of oil and 1.45 billion cubic feet of non-CBNG (Wyoming Oil and Gas Conservation Commission 2004).

As of the end of 2003, approximately 3,500 producing conventional oil and gas wells were in the Wyoming PRB study area plus 1,386 seasonally active wells (IHS 2004). The Wyoming Oil and Gas Conservation Commission reported that these wells produced approximately 13 million barrels of oil and 40 billion cubic feet of conventional gas in 2003 (Wyoming Oil and Gas Conservation Commission 2004). The USGS (2002a) estimated that the mean undiscovered noncoal bed hydrocarbon resource in the PRB (including Montana) is 1.8 billion barrels of oil equivalent.

Most of Wyoming's current oil production is from old oil fields with declining production, and the level of exploration drilling to discover new fields has been low (Wyoming State Geological Survey 2002). This situation is reflected in the PRB where, over the 10-year period from 1992 through 2002, oil production from conventional oil and gas wells in Campbell and Converse counties decreased approximately 60.4% (from 32.8 million barrels in 1992 to 13.0 million barrels in 2002). Oil prices have been increasing, which is reversing projections of a continuing decline in oil and gas production. Thus, production is now expected to increase in the PRB, with a peak around 2010 of approximately 15.7 million barrels (WSO-RMG 2005). Oil production in the short term may also be bolstered by some planned CO_2 flood projects in the PRB (Wyoming State Geological Survey 2003). This projected temporary upward trend in conventional oil and gas development is reflected in the PRB Coal Review projections (table 4-6).

Table 4-6. Baseline Year and Projected Wyoming PRB Conventional Oil and Gas Development Scenario

Category	Existing		Projected for Task 3 Study Area		
	2003 Task 1 Study Area	2003 Task 3 Study Area	2010	2015	2020
Annual Gas Production (billion cubic feet)[1]	39.9	36.3	33.8	30.9	28.0
Annual Oil Production (million barrels)	12.9	11.4	13.8	12.5	11.2
Active and Seasonably Active Wells	5,067.0	3,890.0	5,603.0	5,115.0	4,625.0

[1] Future gas production per well was estimated based on 2003 production levels per subwatershed. A greater number of future well sites were assumed to occur in locations with historically lower production rates, so the projected future conventional gas production varies within the cumulative effects study area relative to the number of projected producing wells.

Source: PRB Coal Review Task 2 Report (BLM 2005b)

The active wells identified in table 4-6 include wells that produce year-round, seasonally producing wells, and service wells (mainly injection wells). It is estimated that there are approximately 2,000 idle conventional oil and gas wells in the PRB study area (Wyoming Oil and Gas Conservation Commission 2005). However, the number of idle wells would gradually be reduced in the future through plugging programs, and the idle well locations (once the wells are abandoned) would be reclaimed, and would no longer represent a disturbance.

4.1.2.2 CBNG Development

Natural gas production has been increasing in Wyoming. In the PRB, this is due to the development of shallow CBNG resources. Commercial development of these resources began in

limited areas west of and adjacent to the northernmost surface coal mines in the late 1980s. Since that time, CBNG development has spread south and west into other parts of the PRB Coal Review Task 1 and Task 2 study area.

On private and state oil and gas leases, the Wyoming Oil and Gas Conservation Commission and the Wyoming SEO authorize CBNG drilling. On federal oil and gas leases, the BLM must analyze the individual and cumulative environmental impacts of all drilling (federal, state, and private), as required by NEPA, before CBNG drilling can be authorized. The BLM does not authorize drilling on state or private leases but must consider the impacts from those wells in their NEPA analyses. In many areas of the PRB, the coal estate is federally owned, but the oil and gas estate is privately owned. A June 7, 1999 Supreme Court decision (98-830) assigned the rights to develop CBNG on a piece of land to the owner of the oil and gas estate.

Annual CBNG production increased rapidly in the PRB between 1999 and 2003 but has leveled off somewhat since then. At the end of 2003, 14,758 producing CBNG wells were in the study area (IHS 2004), and total production for 2003 was 346 billion cubic feet, or 88% of the total gas production from the basin (Wyoming Oil and Gas Conservation Commission 2004). Total production for 2006 was 377 billion cubic feet (Wyoming Oil and Gas Conservation Commission 2007). Average daily CBNG production was 900 million cubic feet of gas per day in 2003 (Holcomb 2003), and it is estimated that it will average 1,150 million cubic feet of gas per day for 2007 (Wyoming Oil and Gas Conservation Commission 2007). From 1987 to 2003, the total cumulative gas production from PRB coals was over 1.2 trillion cubic feet. The total water production for the same period was approximately 2.3 billion barrels (96,600 million gallons). Water production in 2003 amounted to more than 500 million barrels (21,000 million gallons), or about 1.4 million barrels per day. According to the Wyoming Oil and Gas Conservation Commission website, water production in the PRB associated with CBNG production has varied between just over 1.4 million barrels per day and about 2.2 million barrels per day since December 2003.

Since the early 1990s, the Wyoming BLM has completed numerous environmental assessments and two EISs analyzing CBNG projects. The most recent of these is the four-volume final EIS and proposed plan amendment for the PRB oil and gas project, completed in January 2003 (BLM 2003). The level of CBNG development since 2003 appears to be lower than was forecast in that document. New CBNG well numbers fell from a high of slightly more than 4,600 in 2001 to approximately 2,000 in 2004. The PRB Coal Review Task 2 Report discusses the uncertain trends for future CBNG activity in recent years. The methodology used to project future activity is detailed in appendix E of that report. Table 4-7 shows the 2003 and projected 2010, 2015, and 2020 levels of CBNG development used to evaluate projected cumulative environmental impacts in the PRB Coal Review.

Table 4-7. Baseline Year and Projected CBNG Development Scenario for Wyoming PRB

	Existing		Projected to Task 3 Study Area		
Category	2003 Task 1 Study Area	2003 Task 3 Study Area	2010	2015	2020
Annual Production (billion cubic feet)	338	284	480	500	443
Active Wells	14,758	12,152	20,899	21,831	19,366

Source: PRB Coal Review Task 2 Report (BLM 2005b)

4.1.2.3 Oil and Gas-Related Development

Oil and gas-related development activities considered in the PRB Coal Review include major transportation pipelines and refineries. Table 4-8 summarizes the net disturbance, reclamation, and water production associated with oil and gas activity (conventional oil and gas, CBNG, and major transportation pipelines) for 2003 (baseline year) and projects disturbance, reclamation, and water production for future years.

Table 4-8. Wyoming PRB Conventional Oil and Gas, CBNG, and Related Development Disturbance and Water Production

	Existing[1]		Projected for Task 3 Study Area[1]		
Category	2003 Task 1 Study Area	2003 Task 3 Study Area	2010	2015	2020
Cumulative Disturbed Area (acres)[2]	187,761	148,602	237,883	304,543	361,331
Cumulative Permanently Reclaimed Area (acres)	115,045	90,548	160,175	225,426	288,536
Cumulative Unreclaimed Area (acres)	72,715	58,053	77,707	79,108	72,794
Annual Water Production (million gallons per year)	26,405	21,204	39,108	41,484	37,350

1 Minor discrepancies in total acreages are the result of number rounding.

2 Inclusive of conventional oil and gas and CBNG activities and major transportation pipelines. Disturbance associated with ancillary facilities (including gathering lines and distribution power lines) has been factored in a per well basis.

Source: PRB Coal Review Task 2 Report (BLM 2005b)

Pipelines

The availability of pipeline capacity for the transport of oil and gas to outside markets is a key factor in the development of CBNG and conventional oil and gas resources in the Wyoming PRB. In 2003, the baseline year for the PRB coal Review, there were 13 major transportation pipeline systems that transported gas resources to markets outside of the basin (Flores et al. 2001). The 2003 capacity of these pipeline systems was 1.9 billion cubic feet per day. The combined natural gas production (CBNG and conventional gas) in the Wyoming PRB Coal Review Task 1 and Task 2 study area was approximately 1.03 billion cubic feet per day.

Major transportation pipelines also provide for transport of CO_2 to conventional oil fields for enhanced oil recovery. Increased recovery of crude oil also may depend somewhat on the

availability of CO_2 for enhanced oil recovery projects, as well as the availability of pipelines to transport oil to refineries for processing.

Gathering lines and power lines associated with conventional oil and gas and CBNG development also occur within the study area; disturbance from these ancillary facilities were factored into the PRB Coal Review analysis on a per well basis.

A 315-mile-long pipeline project, the Bison Pipeline Project, was proposed in 2004 to move natural gas northward, directly out of the PRB and into the Northern Border Pipeline system (Federal Energy Regulatory Commission 2004). Approximately 53 miles of the proposed route is within the Wyoming PRB Coal Review study area. If it is constructed, it would have a 240 million cubic feet per day capacity as proposed. The Federal Energy Regulatory Commission had expected the Bison project proposal to be filed in December 2003, but no filing has been made with the Federal Energy Regulatory Commission (Federal Energy Regulatory Commission 2004), and the project is not included as an active project in Wyoming on the Federal Energy Regulatory Commission website. As a result, the Bison Pipeline project was assumed to have a low likelihood rating for the purposes of the PRB Coal Review.

The following two proposed pipeline projects in the PRB were listed on the Wyoming Pipeline Authority webpage (http://www.wyopipeline.com) as of October 2007: MDU Resources Group, Inc. Williston Basin Interstate Pipeline 'Grasslands Pipeline' Expansion and ONEOK Cantera Gas Holdings Fort Union Gas Gathering Expansion. These are both expansion projects which involve adding capacity to an existing pipeline. Information on pipeline projects proposed in Wyoming can also be found in the "For Citizens" section of the Federal Energy Regulatory Commission's website at http://www.ferc.gov.

The amount of available pipeline capacity could limit the amount of future CBNG development. In 2003, it was estimated that growth of Wyoming PRB CBNG production could rise from the 2003 level of 900 million cubic feet per day up to 3 to 4 billion cubic feet per day per day around 2007 and remain at or above those levels until 2015 (Holcomb 2003). If CBNG production levels reach 3 to 4 billion cubic feet per day, it is reasonable to assume that several pipeline projects with up to 1.0 billion cubic feet per day capacity each could be built in the PRB. However, as discussed previously, the actual average production for 2007 is currently projected to be 1.15 billion cubic feet per day and, based on the assumptions in appendix G of the PRB Coal Review Task 2 Report, the basin-wide CBNG production is projected to reach approximately 1.7 billion cubic feet per day in 2020. New pipeline construction projects were not considered in the PRB Coal Review analysis because the likelihood for additional new pipeline construction was unknown when the PRB Coal Review was prepared.

The CO_2 pipeline from Bairoil, Wyoming, to Salt Creek, Wyoming, may be extended into the PRB Coal Review study area to the Sussex Field to support additional enhanced oil recovery. Although it took many years for a CO_2 source to reach the Wyoming PRB, it is very likely that several pipelines could be built in the study area in the near future to provide additional gas for enhanced oil recovery projects. However, no pipeline projects were identified that would

transport CO_2 beyond Salt Creek, and the likelihood for construction of additional CO_2 pipelines was unknown when the PRB Coal Review analysis was prepared, and they were not considered.

Refineries

Construction of a new refinery was completed in the Wyoming PRB study area in 2008. The NorthCut Refinery, owned and operated by Interline Resources, is located in Converse County, approximately 20 miles north of Douglas, Wyoming. Construction of the refinery, which was a conversion of the previously existing Well Draw Gas Plant, included installation of a crude oil pipeline between the company's existing crude gathering system and the refinery.

The NorthCut Refinery is a crude oil topping plant, specifically engineered to process 4,000 barrels per day of sweet crude produced in the PRB. Output from the refinery will include naptha, off-road diesel, and reduced crude oil. The markets for the products include ethanol manufacturers, mines, and other refineries. The company-owned crude oil pipeline and third-party tanker trucks will be used for delivery of crude stocks. Tanker trucks also will be used to transport finished products from the facility (Interline Resources 2008).

The refinery is adjacent to and east of Wyoming 59, with the joint BNSF and UP rail line located just to the west of the highway. The site previously had been the location of the Well Draw Gas Plant (approximately 20 acres), which shut down in 2002 following a fire. Interline has acquired an additional 12 acres bordering the original site for administrative, maintenance, and transportation-related uses (Interline Resources 2008).

The level and composition of outputs from the existing NorthCut Refinery would respond to various markets, potentially resulting in the construction of additional infrastructure and/or facilities in the future. Any future changes and associated disturbances would occur within the property currently owned by Interline Resources (Williams, pers. comm.). No specific plans for expansion have been identified. As a result, the likelihood for project expansion is considered speculative. Therefore, it has been eliminated from further analysis in this study.

No other reasonably foreseeable plans for construction and operation of new petroleum refineries in the Wyoming portion of the PRB have been identified.

4.1.3 Other Development Activity

4.1.3.1 Other Mining

Uranium, sand, gravel, bentonite, and clinker (or scoria) have been and are being mined in the Wyoming PRB study area.

There are three defined uranium districts in the PRB: Pumpkin Buttes, Southern Powder River, and Kaycee (BLM 2003). Numerous mined out or uneconomic uranium mining sites are present in these districts. Uranium is currently produced in the Southern Powder River District using the in-situ leach method. There is one operating in-situ uranium recovery site in the PRB, the Smith Ranch-Highland Mine in Converse County, but the recent increase in interest in uranium for

power plants here and abroad is generating interest in new development in the PRB. According to the U.S. Nuclear Regulatory Commission website (http://www.nrc.gov), interest has been expressed in restarting in-situ operations at the Christianson Ranch Site in Johnson County, Wyoming. An application has been received from Energy Metals Corporation to construct and operate an in-situ uranium recovery facility at Moore Ranch in Campbell County, Wyoming. Based on commodity forecasts and uranium activity as of June 2004, the likelihood and potential timing of new uranium mining operations in the PRB was not known, and additional development was not projected in the PRB Coal Review analysis.

In the original Task 2 reports (BLM 2005b), reasonably foreseeable uranium development was eliminated from further consideration because: 1) there were no specific projects with pending applications and 2) no development was anticipated based on market conditions. Due to increased overall demand for energy in recent years, uranium prices have increased from a low of $7.00 a pound in 2001 to over $138 a pound in 2007 (Barry 2008). The price fell precipitously after that, but it appears to be stabilizing at approximately $75 per pound.

In response to the increased price of uranium, a number of uranium mine developments are proposed in the Wyoming PRB study area (table 4-9). These include seven new proposed developments, two proposed expansions, and one proposed restart, all of which would use in situ recovery. Most of the proposed developments are in the Pumpkin Buttes uranium district in southwestern Campbell County. The actual number of the proposed developments that would become operational would depend on several factors including price and approval of permits.

Bentonite is weathered volcanic ash that is used in a variety of products, including drilling mud and kitty litter, because of its absorbent properties. There are three major bentonite producing districts in and around the PRB: the Colony District in the Northern Black Hills, the Clay Spur District in the Southern Black Hills, and the Kaycee District west of Kaycee, Wyoming. Within the PRB Coal Review study area, bentonite is mined at Kaycee (Wyoming Mining Association 2006). The PRB Coal Review assumed that bentonite mining would continue throughout the study period and that production would continue at existing active mines, with no new mines developed through 2020.

Aggregate, which is sand, gravel, and stone, is used for construction purposes. In the PRB, the more important aggregate mining localities are in Johnson and Sheridan counties (Wyoming State Geological Survey 2004). The largest identified aggregate operation is located in northern Converse County. It has an associated total disturbance area of approximately 67 acres, of which four acres have been reclaimed.

Scoria or clinker (which is formed when coal beds burn and the adjacent rocks become baked) is used as aggregate where alluvial terrace gravel or in-place granite/igneous rock is not available. Scoria generally is mined in the Converse and Campbell counties portion of the Wyoming PRB study area.

Table 4-9. U.S. Nuclear Resources Commission Applications for In-Situ Recovery Uranium Projects in the Wyoming PRB Study Area

Project/ Company	Location	Type Application	Watershed/Mining District	Likelihood/ Rationale
Moore Ranch/Uranium One (formerly Energy Metals Corporation)	T41-42N, R74-75W; Campbell and Converse counties.	New	Antelope Creek, Upper Powder River/Pumpkin Buttes District	Moderate for 2010. Application filed with USNRC October 2007.
Nichols Ranch-Hank Unit/Uranerz	Nichols Ranch: T43N, R76W; Campbell and Johnson counties. Hank Unit: T43-44N, R75W; Campbell County.	New	Upper Powder River/Pumpkin Buttes District	Moderate for 2010. Applications filed with USNRC and WDEQ.
Christensen Ranch/Cogema	T44N, R76W; Johnson County.	Restart	Upper Powder River/Pumpkin Buttes District	Moderate for 2010. USNRC application pending, received April 2007.
Smith Ranch/Cameco (Power Resources)	T36N, R74W; Converse County.	Expansion	Middle North Platte River/South Powder	Moderate for 2015. Expansion of existing facility, letter of intent March 2008, application expected 2009.
North Butte/Cameco	T44N, R76W; Campbell County.	Expansion	Upper Powder River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Collins Draw/Uranerz	T42N, T43N, R76W; Campbell County.	New	Upper Powder River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Ludeman-Allemand-Ross/Uranium One	Converse County	New	Antelope Creek	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Ruby Ranch/Cameco	T43N, R75W; Campbell County	New	Upper Belle Fourche River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Reno Creek/ Strathmore Minerals Corporation	T43N, R73; Campbell County	New	Upper Belle Fourche River, Antelope Creek/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2010.
Southwest Reno Creek/Strathmore Minerals Corporation	T42-43N, R73-74W	New	Antelope Creek/Pumpkin Buttes District	Speculative. No information on applications available.

USNRC = U.S. Nuclear Regulatory Commission

Sources: Strathmore Minerals Corporation (2008), USNRC (2008a, 2008b, 2008c); World Information Service on Energy (2007)

Increased sand, gravel, and scoria production and associated surface disturbance are anticipated in the Wyoming PRB study area in the future because aggregate would be required for road maintenance and new construction activities as other primary resources, such as coal and oil and gas, continue to be developed. New operations and increased production from existing operations can be expected. These operations would vary in size based on the immediate need from the primary industries, but there is no specific information about these projected operations. As a result, new sand, gravel, or scoria operations were not analyzed in detail in the PRB Coal Review.

4.1.3.2 Industrial Manufacturing

A number of existing industrial manufacturing establishments are located in the Wyoming PRB Coal Review study area. Most are relatively small with fewer than 25 employees; they predominately serve regional and local markets, and most are directly or indirectly related to energy resource development and production. Over the years, some of these firms have expanded such that they now support activities and serve markets outside of the region, but those operations remain dependent upon the local and regional markets to sustain their existing operations.

The PRB Coal Review anticipates that increased coal production would result in an increased demand for fuels and explosives. This increased demand could result in the need for the development of new off-site chemical feedstock plants in the study area. Project-specific information is not available, however, and the potential development of new chemical feedstock plants was not considered in the PRB Coal Review.

Local economic development organizations, including Campbell County Economic Development Corporation and Converse Area New Development Organization, are continually engaged in efforts to recruit or assist new business formation in the PRB study area. For example, the latter has pursued development of long-term potential projects; however, the outcomes of those projects are uncertain and little information and detail are available. As a result, they were not considered in the PRB Coal Review.

4.1.3.3 Wind Power

Wind power facilities have been proposed at various sites in Wyoming, including the Powder River Basin region. There is potential in the Wyoming sites for wind power, and these facilities can contribute to meeting forecasted electric power demands; however, they depend on available transmission capacity to send power to users. The transmission capability is a constraining factor (Grasseschi 2008). Wyoming ranks seventh in terms of wind energy potential with current production in 14th place with 459 MW. Although many Wyoming locations having the highest potential are in the southern portion of the state, areas in both Converse and Campbell counties offer sufficient potential to support commercial-scale wind generation projects

- One such project currently is under development in the Wyoming PRB study area, and another is in the planning stages. PacifiCorp is constructing a three-phase project in Converse County, approximately 15 miles north of the existing Dave Johnston Power Plant, on and near the site of the former Dave Johnson Mine. The first two phases, known as the Glenrock Wind Energy Project and the Rolling Hills Wind Energy Project, were scheduled for completion in 2008. The third, currently unnamed phase is anticipated to be constructed between 2009 and 2011, depending on market demands and the performance of the first two phases. Each phase would consist of 66 wind turbine generators (each rated at 1.5 MW [99-MW total]) mounted on 80-meter-tall tubular towers, plus ancillary support facilities (PacifiCorp 2007). This project is considered highly likely.

- Third Planet Windpower is in the initial development phase of a wind generating project in the Pumpkin Buttes area of southwestern Campbell County. This company has acquired 13,000 acres of land leases for the project, installed meteorological towers on site, and is currently doing environmental and feasibility studies. Contingent upon the meteorological data and other results, the company could install up to 167, 1.5-MW towers, yielding a total capacity of 250 MW, if fully constructed (Gartrell 2008). The site for the Reno Junction wind farm is near the Black Hills Power substation, and the companies are seeking an agreement for interconnection. Third Planet Windpower plans to start construction in June of 2010 with an online date in the end of 2010.

4.1.3.4 Solar Power

Although Wyoming has been given a rating of very good for annual solar potential for flat plate collectors, there currently are no utility scale solar power collection facilities on federal, state, or private lands in the state of Wyoming. Furthermore, no applications for the development of utility scale solar energy projects have been filed as of January 1, 2009.

The BLM and the U.S. Department of Energy (DOE) are jointly preparing a solar energy programmatic EIS which could facilitate future solar energy development application processes. Wyoming is not covered in the programmatic EIS but still may be affected by it. Information on the programmatic EIS can be found at: http://solareis.anl.gov. The BLM currently evaluates solar energy project proposals on a case-by-case basis.

Solar energy use in Wyoming is, as of January 1, 2009, limited to private residences and private commercial establishments. Current Wyoming solar energy incentives include a sales tax rebate on industrial or commercial solar energy generation equipment, a onetime grant of up to $3,000 offered thru lottery from the Wyoming Business Council, and the utility buy back of unused electricity at the wholesale price. Solar energy production equipment and installation at residential, commercial, and utility sites is expensive. Currently, the electric utility costs in Wyoming are such that the cost of installation does not favor solar energy development over existing forms of energy development.

4.1.3.5 Reservoirs

Currently, there are five key water storage reservoirs in the Wyoming PRB Coal Review study area (Healy, Lake DeSmet, Muddy Guard No. 2, Gillette, and Betty No. 1) (HKM Engineering et al. 2002a and 2002b). The total disturbance associated with these five key water storage areas is 3,263 acres.

Based on the applicable water plans prepared for the Wyoming Water Development Commission for its Basin Planning Program (HKM Engineering et al. 2002a and 2002b), there are long-range projections for development of additional reservoirs in the study area. However, none of these reservoirs have reached the planning stage; therefore, there was not enough information to analyze them in the PRB Coal Review.

4.1.3.6 Other Non-Energy Development

In addition to the specific projects and developments described above, a network of public and private physical infrastructure, private enterprises, and public activities has been developed in the PRB over time. Examples of infrastructure include the highway and road networks, airports, government offices, hospitals, public schools, municipal water systems, and extensive residential and commercial real estate development. Private enterprises include local retail and service establishments, newspaper publishing, and transportation and distribution firms.

The construction, maintenance, and continuing operations associated with this network of development represent an extensive series of public and private investments, as well as changes in land use, surface disturbances, water consumption, and the factors that characterize local air quality. Those investments and changes have occurred over a period of time and in response to many different influences.

Some of the identified and anticipated plans or proposals for future investment in public, private, and commercial infrastructure in the PRB are summarized below.

- The 2008 annual State Transportation Improvement Program includes planned construction for the 2008 fiscal year and preliminary engineering estimates for projects with anticipated construction dates through 2013 in the PRB Coal Review Study Area. In general, Wyoming transportation projects scheduled over the next six years include maintenance, reconstruction, and improvement projects. Airport improvement plans consist primarily of pavement rehabilitation and overlays, with some minor expansion of taxiways, aprons, and parking. No construction of new highways is scheduled, and no new airports are proposed.
- In addition to highway projects included in the 2008 State Transportation Improvement Program, the Eagle Butte Mine has received approval from Wyoming Department of Transportation to relocate a portion of U.S. Highway 14-16 in the vicinity of the Gillette/Campbell County Airport, north of the city of Gillette. The relocation is proposed to facilitate the recovery of approximately 40 million tons of additional coal recently acquired by the mine through the Eagle Butte West LBA tract coal sale. Three alternative alignments, involving the construction of up to 6.8 centerline miles of new roadway, were identified and a preferred alternative was subsequently chosen and approved by the Wyoming Department of Transportation. Construction of the new highway segment is underway, with completion of the project anticipated in 2011/2012 (Wyoming Department of Transportation and Foundation Coal Company 2008).
- A $10.7 million expansion and renovation of the Campbell County courthouse was completed in late 2005, and a new public health building was completed in 2007.
- Expansion of the county's detention center and remodeling of the sheriff's office were undertaken in 2007.
- Expansion of the CAM-PLEX conference and multi-event center facility in Gillette was approved in a special election in May 2005.

- The 2005 approved master plans for Wyoming public school facilities spending included a total of $72.3 million in new capital construction for the seven school districts that are completely or partially in the Wyoming PRB study area (Wyoming School Facilities Commission 2005).
- Construction and maintenance projects for the city of Gillette include a recently completed project to renovate and expand the waste water treatment plant.
- Commercial development includes recently completed construction of a Home Depot store and expansion of the Wal-Mart store in Gillette.
- A new $10 million headquarters for the Campbell County Fire Department providing administrative, training, and storage space in addition to multiple parking bays for firefighting apparatus has been completed.
- A $55 million county recreation center is being planned, with opening expected in 2010.
- The city completed construction of a new Health Sciences Center at Gillette College. The facility will house the school's nursing program, providing classrooms, labs, faculty offices, and other spaces. The nursing program functions in conjunction with the Campbell County Memorial Hospital.
- The county, city, and Gillette College are partnering on a Campus Housing Complex and Industrial Technical Education Center. These facilities are part of a long-range master plan for the college that is designed to provide a broad college-level curriculum and provide more focused education and training to support local business and industry.
- Campbell County Memorial Hospital is in the planning stage for a major expansion and renovation project (City of Gillette 2008a).

A capital facilities tax ballot question in Campbell County in the 2004 election asking voters to approve the imposition of a $0.01 sales and use tax (to be used for updated and expanded diesel mechanic and welding programs at the Gillette Campus of the Northern Wyoming Community College (now Gillette College) and for two community development projects in Wright) and an increase in the lodging tax were defeated in 2004. A renewed attempt to get the lodging tax on the ballot for the 2006 primary election failed to gain the approval of the Campbell County Board of Commissioners. In their 2007 session, the Wyoming Legislature committed to pay half of the cost of a technical education center at Gillette College that will house diesel technology, welding, and industrial electrician programs. The Campbell County Board of Commissioners has approved a tax increase to pay for the other half of the cost of the project. Construction of this project is ongoing.

Given the timing, scale, year-to-year variability, relatively short construction timetables associated with such investments, the existence of a relatively large and diversified construction industry in the region and nearby areas, and the limited potential for these projects to alter long-term conditions in the PRB, they are not included in the PRB Coal Review analysis. However, one or more of these and similar projects could warrant consideration in a cumulative analysis for a site-specific project due to proximity or coincidental project schedules and timetables.

4.2 Cumulative Environmental Consequences

Section 4.1 of this chapter discussed existing and projected levels of development in the Wyoming PRB, and included summaries of the results of PRB Coal Review Task 2 studies. This section summarizes the existing conditions resulting from baseline year (2003) development and the cumulative environmental consequences of the projected development for 2010, 2015, and 2020 based on the results of the analyses conducted for PRB Coal Review Task 1 and 3 reports, respectively.

As discussed in the previous section, the Wyoming portion of the PRB is the primary focus of the PRB Coal Review analyses. For the majority of resources in the Task 1 analysis, the Wyoming PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson counties outside of the Bighorn National Forest, and the northern portion of Converse County (map 4-1). The study areas for the Task 3 analyses are different. For the majority of the resources considered in the PRB Coal Review, the Task 3 study area is based on watershed boundaries in the PRB and includes the portions of the Upper Powder River, Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, Antelope Creek, and Dry Fork Cheyenne River subwatersheds that lie within Sheridan, Johnson, Campbell and northern Converse counties (map 4-2). This study area includes over 4 million acres. Table 4-10 summarizes the total disturbance and reclamation acreages for the baseline year of 2003 and the total projected disturbance and reclamation acreages for 2010, 2015, and 2020 within the Task 3 study area described above.

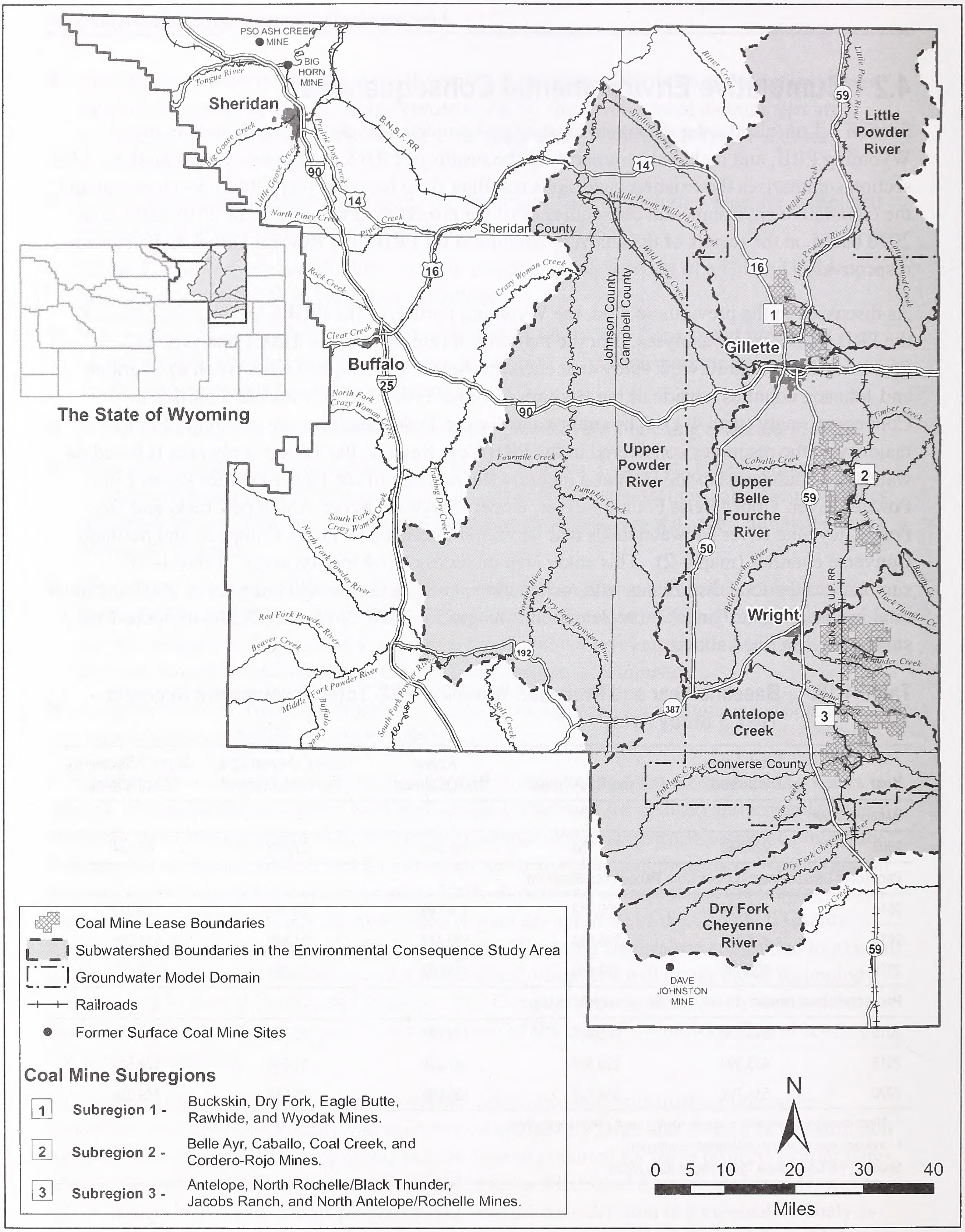
Table 4-10. Baseline Year and Projected Wyoming PRB Total Development Scenario – Task 3 Study Area

Year	Total Acres Disturbed[1]	Acres Reclaimed[1]	Acres Unreclaimed[1]	Acres Unavailable for Reclamation[2]	Acres Affected by Coal Mining
Baseline Year					
2003	220,688	111,786	108,901	27,073	68,794
Projected Development - Lower Coal Production Scenario					
2010	339,912	205,113	134,799	29,389	98,662
2015	426,084	286,614	139,472	31,546	117,236
2020	503,085	367,999	135,085	32,794	137,443
Projected Development - Upper Coal Production Scenario					
2010	343,698	206,946	136,752	28,739	102,448
2015	433,392	290,822	142,570	31,006	124,545
2020	514,732	374,732	139,998	32,342	149,089

[1] Minor discrepancies in total acreages are the result of number rounding.

[2] Includes coal mine and coal-related disturbance.

Source: PRB Coal Review Task 2 Report (BLM 2005b)



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map 4-2

Wyoming Task 3 Study Area for PRB Coal Review Studies Evaluating Projected Environmental Consequences

A total of approximately 220,688 acres of this land area had been disturbed by development activities as of 2003, which represents about 5.6% of the Task 3 study area. This is projected to increase to as much as 514,732 acres in 2020 under the upper coal production scenario which would represent approximately 13.1% of the Task 3 study area. This projected disturbance includes coal mining, coal-related development, and oil and gas and related development disturbance in the Task 3 study area. Areas reclaimed during each future period shown in table 4-10 reflect how much of the disturbed acreage is projected to be permanently reclaimed by that point in time. The acres of unreclaimed disturbance would be reclaimed incrementally or following a project's completion, depending on the type of development activity and permit requirements. The acres currently not available for reclamation are occupied by long-term facilities that are needed to conduct mining operations or coal-related activities. These areas would be reclaimed near the end of each mine or facility's life.

Adjustments were made to the study area described above and shown on map 4-2 for several resources as described below:

- The potential air quality impacts were evaluated over a multi-state area (including most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and northwestern Nebraska) because they would be expected to extend beyond the Wyoming and Montana PRB study area that was used to identify emissions sources for the air quality analysis.
- The groundwater drawdown was evaluated in the area surrounding and extending west of the surface coal mines shown on map 4-2, because that is the area where groundwater drawdown related to surface coal mining operations and CBNG production operations would overlap.
- The socioeconomic impact analysis focused on Campbell County, but also considered Converse, Crook, Johnson, Sheridan, and Weston counties as directly affected and Niobrara and Natrona counties as indirectly affected.

4.2.1 Topography and Physiography

The PRB is located within the Upper Missouri Basin Broken Lands physiographic subprovince that includes northeastern Wyoming and eastern Montana to the Canadian border. The topography generally is of low to moderate relief with occasional buttes and mesas. The general topographic gradient slopes down gently from southwest to northeast with elevations ranging from 5,000 to 6,000 feet above sea level on the southern and western portions of the basin to less than 4,000 feet above sea level on the north and northeast along the Montana state line. The major drainages in the basin are the Tongue, Powder, Belle Fourche, and Cheyenne rivers. Most of the drainages in the area are intermittent and have flows during high precipitation events or during periods of snowmelt. The drainages are part of the upper Missouri River Valley drainage basin.

The disturbance associated with the majority of the past, present, and projected activities have resulted in or would result in the alteration of the surface topography. Surface coal mining,

which is projected to continue in the area of the existing coal mines shown on map 4-2, permanently alters the topography by removing the overburden and coal and then replacing the overburden.

Recontouring during reclamation to match approximate original contours, as required by regulation, reduces the long-term impact on topography. After mined-out areas are reclaimed, the restored land surfaces are typically gentler, with more uniform slopes and restored basic drainage networks. Oil and gas exploration and development has occurred and is projected to continue throughout most of the Task 3 study area. It also results in the alteration of topography to accommodate facilities (e.g., well pads, power plants) and roads, but the disturbance tends to occur in smaller, more discrete areas than coal mining and the development is spread out over a larger area.

The disturbance and reclamation acreages associated with all existing and projected development in the Task 3 study area for the years 2003, 2010, 2015, and 2020 are given in table 4-10.

4.2.2 Geology, Mineral Resources, and Paleontology

The PRB Coal Review Task 3 study area (map 4-2) was used to assess cumulative effects for geology, mineral resources, and paleontology.

The PRB is one of a number of structural basins in Wyoming and the Rocky Mountain area that were formed during the Laramide Orogeny. The basin is asymmetric with a structural axis that generally trends northwest to southeast along the western side of the basin (Flores et al. 1999). Natural earthquakes, landsides, and subsidence do not present a hazard in the PRB based on the lack of active faults in the study area (USGS 2004); the low risk of ground shaking in the region if a maximum credible earthquake were to occur (Frankel et al. 1997); and the absence of evidence of subsidence, landslides, or other geologic hazards in association with CBNG production. USGS monitors the magnitude of blasting activity in the PRB under the Routine Mining Seismicity Earthquake Hazards Program (USGS 2008). Coal mine blasting operations-induced seismic activity does occur throughout the PRB and has reached a USGS local magnitude rating of 3.6 (USGS 2004).

4.2.2.1 Coal

Most of the coal resources of the basin are found in the Fort Union and Wasatch formations. Although coals are present in the Wasatch, they are thinner and less continuous than the coals in the Fort Union. Therefore, they are not as economically important as the coals in the Fort Union for either coal mining or CBNG development. Projected levels of coal production and disturbance under the lower and upper coal production scenarios are listed in tables 4-2 and 4-3.

In the coal mine areas, the overburden and coal would be removed and the overburden replaced, resulting in a permanent change in the geology of the area and a permanent reduction of coal resources.

4.2.2.2 Oil and Gas

Drilling for conventional oil and gas in the Wyoming PRB has declined considerably in the last 15 years. However, as discussed above, increasing prices have led to increased interest in drilling, and there remains potential for finding and developing these resources in the deeper formations of the basin. Conversely, CBNG production increased rapidly from 1999 through 2002 but began to level off in 2003. Projected production rates for conventional oil and gas and CBNG in 2010, 2015, and 2020 are shown in tables 4-6 and 4-7.

Oil and gas and related development accounts for most of the projected mineral disturbance outside of the coal mining areas. It generally would result in only shallow, discrete areas of surface disturbance. The acreages over which these impacts were occurring (as of 2003) and are projected to occur in the years 2010, 2015, and 2020 are shown in table 4-10.

4.2.2.3 Other Mineral Resources

As discussed in section 4.1.3.1, other mineral resources that are being mined in the Wyoming PRB include uranium, bentonite, clinker, and aggregate. Production of uranium and bentonite is not likely to be affected by development of coal or CBNG in the PRB. Aggregate and clinker production levels are more likely to be affected by other mineral development levels because these resources would be used in construction projects related to other mineral development.

4.2.2.4 Paleontology

Scientifically significant paleontological resources, including vertebrate, invertebrate, plant, and trace fossils, are known to occur in many of the geologic formations within the Wyoming PRB. These fossils are documented in the scientific literature, in museum records, and are known by paleontologists and land managers familiar with the area.

The Wasatch Formation is the most geographically widespread unit exposed on the surface over most of the Task 3 study area. It is underlain by the Fort Union Formation. The fossiliferous Morrison and Lance formations crop out in the western portion of the basin but occur at depth in the vicinity of the coal mines and CBNG activity in the eastern portion of the basin. Within the Task 3 study area, the highly fossiliferous White River Formation occurs only on Pumpkin Buttes in southwestern Campbell County.

Extremely few significant or unique paleontological localities have been recorded on federal lands in the PRB. However, the lack of recorded localities does not mean that scientifically significant fossils are not present, as much of the area within and surrounding the PRB has not been adequately explored. As a result, development activities in the Task 3 study area have the potential to adversely affect scientifically significant fossils, if they are present in or adjacent to disturbance areas.

The potential for impacts on scientifically significant fossils would be greatest in areas where class 4 or 5 formations are present; with a moderate potential for class 3a (see section 3.3). The Wasatch Formation in the Powder River Basin is classified as a class 3 formation, which means

that fossil content varies in significance, abundance, and predictable occurrence. The Fort Union Formation is classified as a class 4 formation. The greatest potential impact on surface and subsurface fossils would result from disturbance of surface sediments and shallow bedrock during construction and/or operations, depending on the type of project. Potential subsurface disturbance of paleontological resources (during drilling operations) would not be visible or verifiable. The areas over which these impacts occurred as of 2003 and are projected to occur because of all projected development in the years 2010, 2015, and 2020 are shown in table 4-10. As only portions of the Task 3 study area have been evaluated for the occurrence of paleontological resources. Discrete locations for development activities cannot be determined at this time; thus, no accurate estimate can be made as to the number of paleontological localities that may be affected by cumulative development activities.

Development activities which involve federally owned surface and/or minerals are subject to federal guidelines and regulations protecting paleontological resources. Protection measures, permit conditions of approval, and mitigation measures would be determined on a project-specific basis at the time of permitting to minimize potential impacts on paleontological resources as a result of these activities.

4.2.3 Air Quality

There is substantial scientific evidence that increased atmospheric concentrations of GHG and land use changes are contributing to an increase in average global temperature. However since these gases are not regulated pollutants, a discussion of this subject has been included in section 4.2.14.

The Task 1A Report for the PRB Coal Review (BLM 2005d) documents the modeled air quality impacts of operations during a baseline year, 2002, using actual emissions and operations for that year. Emissions from permitted minor sources were estimated, because actual emissions data was unavailable. The baseline year analysis evaluated impacts both within the PRB itself and at selected sensitive areas surrounding the region. The analysis specifically looked at impacts of coal mines, power plants, CBNG development, and other development activities. Results were provided for both Wyoming and Montana at the individual receptor areas. The Task 2 Report for the PRB Coal Review (BLM 2005b) identifies reasonably foreseeable development activities for the years 2010, 2015, and 2020.

The Task 3A Report for the PRB Coal Review (BLM 2006c) evaluates the impacts on air quality and air quality-related values for the year 2010 using the development levels projected for 2010. The same model and meteorological data that were used for the baseline year study in the Task 1A Report. The *Update of Task 3A Report for the PRB Coal Review Cumulative Air Quality Effects for 2015* uses a revised base line year of 2004 with revised projected 2015 scenarios. Impacts for 2015 and 2020 were projected qualitatively based on evaluation of anticipated changes in emissions and on modeled impacts for the 2015 lower and upper coal production scenarios. BLM has updated the model and has conducted impact analysis for 2015 (BLM 2008a). A revised baseline year emissions inventory has been developed using 2004

actual emissions data or emissions estimates and has incorporated the recent analyses of emissions in Wyoming and Montana, which were not available when the 2010 modeling study was done.

Existing and projected emissions sources for the baseline year (2004) and 2015 analyses were identified within a study area comprised of the following counties in the PRB in Wyoming and Montana:

- Campbell County, all of Sheridan and Johnson counties except the Bighorn National Forest lands to the west of the PRB, and the northern portion of Converse County, Wyoming.
- Rosebud, Custer, Powder River, Big Horn, and Treasure counties, Montana.

A state-of-the-art, guideline dispersion model was used to evaluate impacts of the existing and projected source emissions on several source groups, as follows:

- Near-field receptors in Wyoming and Montana covering the PRB Coal Review Task 1A and 3A study area in each state. Overall, the near-field receptor grid points were spaced at one kilometer intervals over the study area;
- Receptors in nearby federally designated pristine or class I areas; and,
- Receptors at other sensitive areas (class II sensitive areas).

The EPA guideline CALPUFF model system version 5.8 (Scire et al. 1999) was used for this study, which differs from the version used in the Task 1A and original Task 3A studies. The impacts for the baseline year (2004) and for 2015 lower and upper coal production scenarios were directly modeled. As discussed above, the modeling domain extends over most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and western Nebraska. An interagency group participated in developing the modeling protocol and related domain that were used for this analysis.

The modeling approach for the updated Task 3A Report used actual emissions from existing sources representative of 2004 operations and projected those emissions for the expected level of development in 2015. Year 2004 emission inventory data were previously developed for the Montana Statewide Oil and Gas Supplemental EIS. No specific emissions data were available for the projected levels of development. The baseline year emissions data were gathered from a variety of sources but mainly relied on data collected by the WDEQ/AQD and the Montana Department of Environmental Quality. Only actual emission sources inside the study area described above were included in the modeling. Key major sources were included, such as the coal-fired power plants, gas-fired power plants, and sources that were included in the Title V (operating permit) program. The Dave Johnston power plant, which is located outside of but adjacent to the study area in Converse County, was included in the baseline year study and in the projected emissions. Some operational adjustments were made to accommodate small sources with air permits that were presumed to be operating at less than full capacity. Emissions from other sources, including estimated construction-related fugitive dust emissions, were computed based on EPA emission factors and on input data from the WDEQ/AQD.

The existing regional air quality conditions generally are very good in the PRB Coal Review Task 1A and Task 3A study area. There are limited air pollution emissions sources (few industrial facilities, including the surface coal mines, and few residential emissions in relatively small communities and isolated ranches) and good atmospheric dispersion conditions. The available data show that the region complies with the ambient air quality standards for NO_2 and SO_2. There have been no monitored exceedances of the annual PM_{10} standard in the Wyoming PRB.

Air quality modeling indicates the projected mine activities at the Buckskin Mine will comply with the PM_{10} and $PM_{2.5}$ near-field and short-term NO_2 air standards for the 2015 modeled air quality impacts at the currently permitted mining rate. The applicant has indicated that they propose to mine either action alternative at a rate below the permit level. Visibility data collected around the region indicate that, although there are some days with notable impacts at class I areas, the general trend in the region shows little change in visibility impacts at Badlands National Park and at the Jim Bridger Wilderness Area from 1989 to 2003 (figure 3.4-2).

Predicted impacts from baseline year (2004) and projected 2015 emissions were modeled for four air quality criteria pollutants (NO_2, SO_2, $PM_{2.5}$, and PM_{10}), along with changes in air quality-related values at class I and identified sensitive areas. For regulatory purposes, the class I PSD evaluations are not directly comparable to the air quality permitting requirements, because the modeling effort does not identify or separately evaluate increment-consuming sources that would need to be evaluated under the PSD program. The cumulative impact analysis focuses on changes in cumulative impacts, but not on a comparison to PSD-related evaluations, which would apply to specific sources.

Table 4-11 presents the modeled impacts on ambient air quality at the near-field receptors in Montana and Wyoming. Results shown represent the maximum impact at any point in each receptor group; data are provided for the baseline year (2004) analysis and for both coal production scenarios for 2015.

Based on the modeling results, the baseline year (2004) maximum impacts on ambient air quality were well below the ambient air quality standards for NO_2, and SO_2. The annual PM_{10} and $PM_{2.5}$ in Wyoming is predicted to be over the WAAQS for the 2015 lower and upper development scenarios. The 2004 maximum modeled 24-hour PM_{10} levels are greater than the 150 $\mu g/m^3$ ambient air standard for some near-field receptors near PRB sources in Wyoming. The modeling also indicated that visibility impacts in the surrounding class I and class II areas for the modeled year 2015 showed some increase in visibility impacts.

For the Montana near-field projected impacts, the modeling for the 24-hour PM_{10} and 24-hour $PM_{2.5}$ levels projects a maximum impact below the NAAQS for both coal production scenarios for 2015. The upper coal production scenario shows an increase in the impact of more than 40% above the baseline year for these parameters. Projected impacts for annual NO_2, SO_2, and annual $PM_{2.5}$ and PM_{10} show compliance with the NAAQS and the Montana State Ambient Air Quality Standards. The 1-hour NO_2 projected levels for the lower and upper development scenarios are

above the Montana standards. Small percentage increases in SO_2 impacts are projected, and the impacts themselves are well below the NAAQS.

For the Wyoming near-field receptors, the modeling projects maximum 24-hour PM_{10} levels greater than the 150 $\mu g/m^3$ ambient air standard for the 2015 lower and upper coal production scenarios at some receptors. For the 2015 upper development scenario, the modeled levels are above150 $\mu g/m^3$ for several relatively small areas surrounding coal mines and CBNG operations in the Wyoming PRB. As shown in table 4-11, the maximum modeled PM_{10} impacts from all sources for the 2015 upper coal production scenario are nearly three times the 24-hour WAAQS standard. The maximum modeled $PM_{2.5}$ impacts from all sources for the 2015 upper coal production scenario are nearly five times the 24-hour WAAQS standard. As discussed in section 3.4.2.2, modeling tends to over-predict the 24-hour impacts of surface coal mining and, as a result, the WDEQ/AQD does not consider short-term PM_{10} modeling to be an accurate representation of short-term impacts. In view of this, a memorandum of agreement between the WDEQ/AQD and EPA Region VIII, dated January 24, 1994, allows the WDEQ/AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This agreement also requires the WDEQ to include "best available work practice" mitigation measures in each PRB mining permit. The monitored exceedances at surface coal mines in the Wyoming PRB and the measures that the WDEQ/AQD has implemented or is proposing to implement to prevent future exceedances of the PM_{10} NAAQS are discussed in chapter 3, sections 3.4.2.1 and 3.4.2.3.

The maximum modeled impacts on the annual PM_{10} and annual $PM_{2.5}$ levels are projected to be above the standard (15 and 50 $\mu g/m^3$, respectively) at near-field receptors in Wyoming for the 2015 upper coal production scenario. EPA has revoked the annual PM_{10} standard of 50 $\mu g/m^3$, but until Wyoming enters into rulemaking to revise the WAAQS, that standard is still effective. It should be noted that the WDEQ/LQD issues permits to mine coal, with input from the AQD division. The agency cannot issue any permit that violates ambient air quality standards. Impacts of NO_2 and SO_2 emissions are predicted to be below the NAAQS and WAAQS at all Wyoming near-field receptors. A large portion of the impacts for all scenarios would be associated with coal-related sources, although non-coal sources would contribute a notable portion of the impact.

Table 4-12 lists the three class I areas and two class II areas where the modeled impacts are the greatest. Table 4-12 includes a comparison to ambient air quality standards and PSD increments; however, it must be noted that this modeling analysis did not separate PSD increment-consuming sources from those that do not consume increment. The PSD-increment comparison is provided for informational purposes only and cannot be directly related to a regulatory interpretation of PSD increment consumption. For the class I Northern Cheyenne Indian Reservation, modeled impacts for the baseline year (2004) and the two coal production scenarios for 2015 are less than the annual SO_2 PSD class I and class II increment and below the PSD class I and class II increment levels for annual PM_{10}, 24-hour SO_2, and 3-hour SO_2. The levels for 24-hour PM_{10} are above the class I and class II PSD increment levels in the base line year of 2004 and show potential exceedances in both the lower and upper development scenarios. For annual NO_2, the

modeled impacts for the Northern Cheyenne Reservations are less than the annual increment for the baseline year and lower and upper coal production scenarios. In the other two class I areas, only the 24-hour PM_{10} impacts are higher than the comparison to the PSD increment levels for the baseline year and both coal production scenarios. In the sensitive class II areas, all modeled impacts are well below the class II PSD increment for the lower coal production scenario. The modeled 24-hour PM_{10} in both of the class II areas indicates potential exceedances in the upper coal production scenario.

The projected modeled visibility impacts for the baseline year (2004) and for the lower and upper coal production scenarios for 2015 for all analyzed class I and sensitive class II areas are listed in table 4-13. For the baseline year, the maximum visibility impacts at class I areas were determined to be at the Northern Cheyenne Indian Reservation in Montana and at Wind Cave and Badlands National Parks in South Dakota. For these locations, modeling showed more than 200 days of impacts with a change of 10% or more in extinction. A 10% change in extinction corresponds to 1.0 dv.

To provide a basis for discussing the modeled visibility impacts resulting from the projected increased production under the lower and upper coal production scenarios for 2015, the modeled visibility impacts for 2004 were subtracted from the model results for 2015. Table 4-13 shows the number of additional days that the projected impacts were greater than 1.0 dv (10% in extinction) for each site for the upper and lower coal production scenarios. Using Badlands Park as an example, the modeling analysis showed 218 days with impacts greater than 1.0 dv in 2004. Under the 2015 lower coal production scenario, the modeling analysis projects an additional 26 days with impacts greater than 1.0 dv, or a total of 244 days with impacts greater than 1.0 dv.

For acid deposition, all predicted impacts are below the deposition threshold values for both nitrogen and sulfur compounds. There are substantial percentage increases in deposition under the lower and upper coal production scenarios for 2010; however, impacts remain well below the threshold values. The acid neutralizing capacity of sensitive lakes was analyzed, and results are summarized in table 4-14. No significant impacts were projected at any of the lakes for the baseline year study; however, the lower and upper coal production scenarios for 2010 show an increased impact at Florence Lake, leading to an impact that is above the 10% acid-neutralizing capacity. Impacts also are predicted to be above the 1 microequivalent per liter (μeq/L) threshold for Upper Frozen Lake.

The study also modeled impacts of selected hazardous air pollutant emissions (benzene, ethyl benzene, formaldehyde, n-hexane, toluene, and xylene) on the near-field receptors in Montana and Wyoming. Model results for the 2010 upper coal production scenario show that impacts were predicted to be above the acute reference exposure level for formaldehyde (94 $\mu g/m^3$) at two receptors in Wyoming but are below all reference exposure and reference concentrations for chronic inhalation levels in Montana and for other compounds in Wyoming. Essentially, the modeled impacts for 2010 showed a continuation of the patterns exhibited for the baseline year analysis.

Table 4-11. Projected Maximum Potential Near-field Impacts (μg/m³)

Pollutant	Averaging Time	Base Year (2004) Impacts	2015 Lower Coal Development Scenario Impacts	2015 Upper Coal Development Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
WYOMING NEAR-FIELD								
NO_2	Annual	31.3	46.7	47.4	100	100	--[1]	25
SO_2	Annual	15.3	16.2	16.2	80	60	---	20
	24-hour	112.3	119.6	119.6	365	260	---	91
	3-hour	462.0	814.1	814.1	1,300	1,300	---	512
$PM_{2.5}$	Annual	13.4	**18.7**	**21.4**	15	15	---	---
	24-hour	**87.6**	**179.5**	**179.5**	35	35	---	---
PM_{10}	Annual	38.4	**53.5**	**61.0**	---	50	---	17
	24-hour	**250.4**	**512.8**	**512.9**	150	150	---	30
MONTANA NEAR-FIELD								
NO_2	Annual	3.3	6.5	6.5	100	---	100	25
	1-hour	409.0	**826.3**	**826.4**	---	---	564	---
SO_2	Annual	1.6	1.7	1.7	80	---	80	20
	24-hour	16.1	16.5	16.6	365	---	365	91
	3-hour	65.0	66.5	66.5	1,300	---	1,300	512
	1-hour	162.9	166.6	166.6	---	---	1,300	---
$PM_{2.5}$	Annual	1.0	1.8	1.9	15	---	15	---
	24-hour	10.2	15.4	20.6	35	---	35	---
PM_{10}	Annual	2.8	5.2	5.3	---	---	50	17
	24-hour	29.1	44.0	58.5	150	---	150	30

μg/m³ = microgram per cubic meter; NAAQS = National Ambient Air Quality Standards; AAQS = Ambient Air Quality Standards; PSD = prevention of significant deterioration; NO = nitrogen oxide; SO_2 = sulfur dioxide; PM_{10} = particulate matter measuring 10 microns or less in diameter; $PM_{2.5}$ = particulate matter measuring 2.5 microns or less in diameter

[1] No standard or increment

Bold values indicate projected exceedance of ambient air quality standards

Source: PRB Coal Review Task 3A Report update (BLM 2008a)

Table 4-12. Maximum Predicted PSD Class I and Sensitive Class II Area Impacts (µg/m³)

Location	Pollutant	Averaging Period	Base Year (2004) Impacts	2015 Lower Coal Development Scenario	2015 Upper Coal Development Production Scenario	PSD Class I/II Increments
CLASS I AREAS						
Northern Cheyenne Indian Reservation	NO_2	Annual	0.4	0.6	0.9	2.5
	SO_2	Annual	0.5	0.6	0.7	2
		24-hour	3.1	3.4	3.4	5
		3-hour	9.4	9.6	9.6	25
	$PM_{2.5}$	Annual	0.3	0.5	0.5	---[1]
		24-hour	3.4	5.1	5.1	---
	PM_{10}	Annual	0.9	1.5	1.5	4
		24-hour	**9.6**	**14.4**	**14.6**	8
Washakie Wilderness Area	NO_2	Annual	0.0	0.0	0.0	2.5
	SO_2	Annual	0.2	0.2	0.2	2
		24-hour	3.0	3.1	3.1	5
		3-hour	6.3	6.3	6.3	25
	$PM_{2.5}$	Annual	0.1	0.1	0.1	---
		24-hour	1.6	1.6	1.6	---
	PM_{10}	Annual	0.2	0.2	0.2	4
		24-hour	4.5	4.6	4.7	8
Wind Cave National Park	NO_2	Annual	0.2	0.3	0.3	2.5
	SO_2	Annual	0.7	0.8	0.8	2
		24-hour	3.7	4.1	4.1	5
		3-hour	7.0	7.4	7.4	25
	$PM_{2.5}$	Annual	0.4	0.5	0.5	---
		24-hour	3.8	4.6	4.7	---
	PM_{10}	Annual	1.0	1.3	1.4	4
		24-hour	**10.9**	**13.3**	**13.6**	8

Location	Pollutant	Averaging Period	Base Year (2004) Impacts	2015 Lower Coal Development Scenario	2015 Upper Coal Development Production Scenario	PSD Class I/II Increments
SENSITIVE CLASS II AREAS						
Big Horn Canyon National Recreation Area	NO_2	Annual	0.6	0.6	0.7	25
	SO_2	Annual	0.5	0.6	0.6	20
		24-hour	3.6	3.7	4.0	91
		3-hour	14.3	14.3	14.3	512
	$PM_{2.5}$	Annual	0.5	0.5	0.7	---
		24-hour	5.9	7.8	11.9	---
	PM_{10}	Annual	1.4	1.6	2.1	17
		24-hour	16.9	22.3	**34.1**	30
Crow Indian Reservation	NO_2	Annual	0.9	1.4	1.7	25
	SO_2	Annual	2.3	2.3	2.3	20
		24-hour	14.4	14.6	14.6	91
		3-hour	76.8	77.0	77.0	512
	$PM_{2.5}$	Annual	0.8	1.0	1.4	---
		24-hour	7.2	9.4	14.3	---
	PM_{10}	Annual	2.2	2.9	4.1	17
		24-hour	20.5	26.9	**40.7**	30

PSD = prevention of significant deterioration; μg/m^3 = microgram per cubic meter; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; PM_{10} = particulate matter measuring 10 microns or less in diameter; $PM_{2.5}$ = particulate matter measuring 2.5 microns or less in diameter

[1] No standard or increment.

Bold values indicate exceedance of PSD class I or II standards.

Source: PRB Coal Review Task 3A Report update (BLM 2008a)

Table 4-13. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas

Location	Base Year (2004)	2015 Lower Coal Development Scenario	2015 Upper Coal Development Scenario
	No. of Days >10%	Change in No. of Days >10%	Change in No. of Days >10%
CLASS I AREAS			
Badlands National Park	218	26	26
Bob Marshall Wilderness Area	8	0	0
Bridger Wilderness Area	144	2	2
Fitzpatrick Wilderness Area	91	2	2
Fort Peck Indian Reservation	105	10	10
Gates of the Mountain WA	55	0	0
Grand Teton National Park	70	2	2
North Absaroka Wilderness Area	61	3	3
North Cheyenne Indian Reservation	243	32	47
Red Rock Lakes	42	2	2
Scapegoat Wilderness Area	27	1	1
Teton Wilderness Area	57	4	4
Theodore Roosevelt National Park	178	5	9
UL Bend Wilderness Area	77	8	10
Washakie Wilderness Area	83	5	5
Wind Cave National Park	262	18	19
Yellowstone National Park	84	2	2
SENSITIVE CLASS II AREAS			
Absaroka Beartooth Wilderness Area	101	2	3
Agate Fossil Beds National Monument	251	20	20
Big Horn Canyon National Rec. Area	331	1	3
Black Elk Wilderness Area	236	34	36
Cloud Peak Wilderness Area	126	18	18
Crow Indian Reservation	360	4	4
Devils Tower National Monument	274	25	25
Fort Belknap Indian Reservation	66	6	7
Fort Laramie National Historic Site	260	10	10
Jedediah Smith Wilderness Area	79	1	1
Jewel Cave National Monument	261	19	21
Lee Metcalf Wilderness Area	97	2	2
Mount Naomi Wilderness Area	51	1	1
Mount Rushmore National Monument	222	36	36
Popo Agie Wilderness Area	139	4	4
Soldier Creek Wilderness Area	268	18	18
Wellsville Mountain Wilderness Area	130	10	10
Wind River Indian Reservation	217	2	5

Source: PRB Coal Review Task 3A Report update (BLM 2008a)

Table 4-14. Predicted Total Cumulative Change in Acid Neutralizing Capacity of Sensitive Lakes

Location	Lake	Background Acid-Neutralizing Capacity (μeq/L)	Area (hectares)	Base Year 2004 Change (percent)	2015 Lower Coal Development Scenario Change (percent)	2015 Upper Coal Development Scenario Change (percent)	Thresholds (percent)
Bridger Wilderness Area	Black Joe	67.0	890.0	4.00	4.11	4.11	10
	Deep	60.0	205.0	4.70	4.82	4.82	10
	Hobbs	70.0	293.0	3.95	4.03	4.03	10
	Upper Frozen	5.0	64.8	2.42	2.47	2.48	1[1]
Cloud Peak Wilderness Area	Emerald	55.3	293.0	5.24	5.97	6.02	10
	Florence	32.7	417.0	9.09	10.41	10.48	10
Fitzpatrick Wilderness Area	Ross	53.5	4,455.0	2.72	2.79	2.79	10
Popo Agie Wilderness Area	Lower Saddlebag	55.5	155.0	6.28	6.42	6.43	10

μeq/L = microequivalents per liter

[1] Data for Upper Frozen Lake presented in changes in μeq/L rather than percent change. (For lakes with less than 25 μeq/L background acid-neutralizing capacity)

Source: PRB Coal Review Task 3A Report update (BLM 2008a)

For 2020, the PRB Coal Review Task 3A Report includes a qualitative analysis of potential air quality impacts and the impacts from individual source groups, based on the projected changes from 2002 to 2010 for the respective coal production scenarios. The production from conventional oil and gas and CBNG activities is projected to peak at 2010, with slight declines predicted over the following decade. The production from CBNG activities is projected to peak at 2015, with slight declines predicted over the following decade. Therefore, from these sources, expected impacts would decrease slightly from 2015 to 2020. The coal mining sources would be the major contributors to PM_{10} impacts in the near-field between 2015 and 2020, and these impacts would result from the proximity of the receptors to the coal mining operations. If coal mines expand or relocate, those impacts likely would follow that development; however, the specific impacts would need to be addressed with a more refined modeling effort.

Power plants are the major contributors to all SO_2 impacts in the near-field in both states. However, the projected impacts are well below any ambient standard or PSD increment. According to the PRB Coal Review Air Quality modeling analysis, predicted future expansion modeled to the year 2020 should not jeopardize the attainment of those standards. Impacts on NO_2 concentrations are the result of emissions from all the source groups. No one source group dominates the NO_2 impacts in the near-field.

A pattern that is similar to the near-field receptors holds true for the class I and sensitive class II receptor groups. Essentially, the mine operations would continue to dominate the PM_{10} impacts, the power plants would continue to dominate the SO_2 impacts (although they would continue to be below the standards), and the overall source groups would continue to contribute to NO_2 impacts, but impacts should remain below the NO_2 standard for 2015 and 2020.

Based on modeling results, none of the acid deposition thresholds were exceeded at class I areas for either the baseline year or for the lower or upper coal production scenarios for 2010. In general, the projected increases in coal development (and power plants) are not expected to raise the deposition levels above the threshold extended into 2020. The only concern relates to the acid deposition into sensitive lakes. The model results showed that the increased deposition, largely from SO_2 emissions from power plants, exceeded the thresholds of significance for the acid-neutralizing capacity at two sensitive (high alpine) lakes. The results indicate that with increased growth in power plant operations, the reduced acid-neutralizing capacity of the sensitive lakes would become significant and would need to be addressed carefully for each proposed major development project.

The WDEQ/AQD and WDEQ/LQD mitigation and monitoring requirements for coal mine emissions are discussed in sections 3.4.2.3 and 3.4.3.3. The discussion in these sections includes the operational control measures that are currently in place and would be required for mining operations on LBAs that are issued in the future, as well as measures that may be required to avoid future exceedances of the WAAQS and NAAQS and/or future mine-related impacts on the public.

4.2.4 Water Resources

Surface and groundwater are used extensively throughout the PRB for agricultural, municipal, domestic, and industrial water suppies. Surface water use is limited to major perennial drainages, and agricultural areas within the basin are found mainly along these drainages. Municipal water supply comes from a combination of surface and groundwater. Domestic and industrial water supply primarily is from groundwater.

The PRB Coal Review Task 1B Report (BLM 2006d) describes the existing water resource conditions in the PRB Task 1 study area (map 4-1). The Task 3B Report update (BLM 2008a) provides an assessment of the cumulative impact on surface and groundwater resources associated with future projected levels of coal mining, coal mine dewatering, CBNG groundwater withdrawal and surface disposal, and coal mine and conventional oil and gas surface disposal of groundwater in the Task 3 study area (map 4-2). The groundwater portion of the impact analysis has not yet been completed. The surface water analysis addresses the cumulative impacts on surface water quality and channel stability as a result of surface discharge of groundwater by CBNG development and coal mine dewatering. The surface water quality portion of this analysis has been completed, but the channel stability portion is not yet complete. The following discussion includes a summary of the results of the Task 1B Report and the Task 3B surface water quality impact analysis, including a recent channel stability study. The Task 3B groundwater impact analysis will be incorporated into future EIS analyses when completed.

4.2.4.1 Groundwater

Five main aquifers are present in the PRB Coal Review Task 1 study area (map 4-1) that can be used for water supply:

- Madison Aquifer System;
- Dakota Aquifer System;
- Fox Hills/Lance Aquifer System;
- Fort Union/Wasatch Aquifer System; and,
- Quaternary Alluvial Aquifer System.

The Fort Union/Wasatch Aquifer System includes the coal and overburden aquifers that are directly affected by surface coal mining and CBNG development. It is also a major source of local water supply for domestic and stock water use. Table 4-15 shows the recoverable groundwater in the components of the Fort Union/Wasatch Aquifer System. The volumes of recoverable groundwater from the sandstones within the Wasatch/Tongue River Aquifer, the Lebo confining layer, and the Tullock Aquifer were determined from the volume of sandstone in each of these units multiplied by the 13% specific yield value for sandstone. Similarly, the volume of recoverable groundwater from the coals within the Wasatch/Tongue River was calculated from the volume of coal multiplied by the 0.4% specific yield value for coal.

Table 4-15. Recoverable Groundwater in the Fort Union/Wasatch Aquifer System

Hydrogeologic Unit	Surface Area (acres)	Average Formation Thickness (ft)	Percentage of Sand/Coal	Average Sand/Coal Thickness (ft)	Specific Yield (percent)	Recoverable Groundwater (acre-ft)[1]
Wasatch-Tongue River Aquifer Sandstones	5,615,609	2,035	50.0	1,018	13.0	743,169,695
Wasatch-Tongue River Aquifer Coals	4,988,873	2,035	6.2	126	0.4	2,514,392
Lebo Confining Layer Sandstones	6,992,929	1,009	33.0	250	13.0	227,270,193
Tullock Aquifer Sandstones	7,999,682	1,110	52.0	430	13.0	447,182,224

ft = feet

1 Calculated by multiplying Surface Area □ Average Sand/Coal Thickness □ Specific Yield. These numbers vary slightly from the numbers presented in table 3-5 of the final EIS and proposed plan amendment for the PRB Oil and Gas Project (BLM 2003).

Source: BLM 2003

Because of statutory requirements and concerns, several studies and a number of modeling analyses have been conducted to help predict the impacts of surface coal mining on groundwater resources in the Wyoming portion of the PRB. Some of these studies and modeling analyses are discussed below.

In 1987, the USGS, in cooperation with the WDEQ and OSM conducted a study of the hydrology of the eastern PRB. The resulting description of the cumulative hydrologic effects of all current and anticipated surface coal mining (as of 1987) was published in 1988 in the USGS Water-Resources Investigation Report, *Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*, referred to herein as the USGS CHIA (Martin et al. 1988). This report evaluates the potential cumulative groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS. The USGS CHIA analysis considered the proposed mining at the Antelope Mine. It did not evaluate potential groundwater impacts related to additional coal leasing in this area, and it did not consider the potential for overlapping groundwater impacts from coal mining and CBNG development.

Each mine must assess the probable hydrologic consequences of mining as part of the mine permitting process. The WDEQ/LQD must evaluate the cumulative hydrologic impacts associated with each proposed mining operation before approving the mining and reclamation plan for each mine, and they must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside of the permit area for each mine. Because of these requirements, each existing approved mining permit includes an analysis of the hydrologic impacts of the surface coal mining proposed at that mine. If major amendments to mining and reclamation permits are proposed, then the potential cumulative impacts of the revisions must also be evaluated. If the proposed tract or an alternative tract configuration is leased to the respective applicant, the existing mining and reclamation permit for the mine must be revised and approved to include the new lease before it can be mined.

The PRB Oil and Gas Project final EIS (BLM 2003) includes a modeling analysis of the groundwater impacts if an additional 39,000 new CBNG wells are drilled in the PRB by the end of 2011. The project area for this EIS, which covers all of Campbell, Sheridan, and Johnson counties, as well as the northern portion of Converse County, is similar to the study area for the PRB Coal Review Task 1 and Task 2 study area (map 4-1).

Another source of data on the impacts of surface coal mining on groundwater is the monitoring that is required by the WDEQ/LQD and administered by the mining operators. Each mine is required to monitor groundwater levels and quality in the coal and in the shallower aquifers in the area surrounding their operations. Monitoring wells are also required to record water levels and water quality in reclaimed areas.

The coal mine groundwater monitoring data are published each year by Gillette Area Groundwater Monitoring Organization (GAGMO), a voluntary group formed in 1980. Members of GAGMO include most of the companies with operating or proposed mines in the Wyoming PRB, WDEQ, the Wyoming SEO, BLM, USGS, and OSM. GAGMO contracts with an independent firm each year to publish the annual monitoring results. That group also periodically publishes reports summarizing the water monitoring data collected since 1980 in the Wyoming PRB (Hydro-Engineering 1991, 1996, and 2001a).

The major groundwater issues related to surface coal mining that have been identified are:

- the effect of the removal of the coal aquifer and any overburden aquifers within the mine area and replacement of these aquifers with backfill material;
- the extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries;
- the effects of the use of water from the subcoal Fort Union Formation by the mines;
- changes in water quality as a result of mining; and,
- potential overlapping drawdown due to proximity of coal mining and CBNG development.

The impacts of large scale surface coal mining on a cumulative basis for each of these issues are discussed in the following paragraphs.

The effect of replacing the coal and overburden with backfill is the first major groundwater concern. The following discussion of recharge, movement, and discharge of water in the backfill aquifer is quoted from the USGS CHIA (Martin et al. 1988):

> Postmining recharge, movement, and discharge of groundwater in the Wasatch aquifer and Wyodak coal aquifer will probably not be substantially different from premining conditions. Recharge rates and mechanisms will not change substantially. Hydraulic conductivity of the spoil aquifer will be approximately the same as in the Wyodak coal aquifer allowing groundwater to move from recharge areas where clinker is present east of mine areas through the spoil aquifer to the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west.

Monitoring data verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991, 1996, 2001a, and 2005). The water monitoring summary reports prepared each year by GAGMO list current water levels in the monitoring wells completed in the backfill and compare them with the 1980 water levels, as estimated from the 1980 coal water-level contour maps. In the 1991 GAGMO 10-year report, some recharge had occurred in 88% of the 51 backfill wells reported at that time (Hydro-Engineering 1991). In the GAGMO 20-year report, 79% of the 82 backfill wells measured contained water (Hydro-Engineering 2001a).

Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining.

The cumulative size of the backfill area in the PRB and the duration of mining activity would be increased by mining the currently pending LBA tracts, including the proposed tract or alternative tract configuration. Because the mined-out areas are being backfilled and the monitoring data demonstrate that recharge of the backfill is occurring, substantial additional impacts are not anticipated as a result of the pending leasing actions.

Scoria or clinker, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (map 3.5-2) and is believed to be the major recharge source for the backfill aquifer, just as it is for the coal. However, not all clinker is saturated. Some scoria is mined for road-surfacing material, but saturated clinker is not generally mined since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. Therefore, current mining is not disturbing the major recharge source for the backfill aquifer. No scoria is present in the proposed tract, but it does occur elsewhere in the BLM study area.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mine. In general, the saturated sand aquifers in the Wasatch Formation overburden have limited extent and, as a result, the drawdowns in that formation are much smaller and cover much less area than the coal drawdowns. In this EIS, assessment of cumulative impacts on groundwater related to surface coal mining is based on impact predictions made by the Buckskin Mine. Those drawdowns are extrapolated to evaluate the potential impacts of mining under the action alternatives. Map 3.5-2 depicts the extrapolated extent of the 5-foot cumulative drawdown contour within the Anderson and Canyon coal aquifers at the Buckskin Mine. The WDEQ/LQD uses the extent of the 5-foot drawdown contour to assess the cumulative extent of the impact on the groundwater system caused by mining operations.

The GAGMO 20-year report provides actual groundwater drawdown information after 20 years of mining (Hydro-Engineering 2001a). Most of the monitoring wells included in the GAGMO 20-year report (488 wells out of 570) are completed in the coal beds, in the overlying sediments, or in sand channels or interburden between the coal beds at 16 active and proposed mine sites. Since 1996, some BLM monitor wells have been included in the GAGMO reports.

The USGS CHIA predicted the approximate area of five feet or more water level decline in the Wyodak coal aquifer which would result from "all anticipated coal mining." "All anticipated coal mining" included 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. All of the currently producing mines, including the Buckskin Mine, were considered in the USGS CHIA analysis (Martin et al. 1988). The study predicted that water supply wells completed in the coal may be affected as far away as 8 miles from mine pits, although the effects at that distance were predicted to be minimal.

As drawdown propagates to the west, available drawdown in the coal aquifer increases. Available drawdown is defined as the elevation difference between the potentiometric surface (elevation to which water will rise in a well bore) and the bottom of the aquifer. The coal depth increases faster to the west than the potentiometric surface declines, so available drawdown in the coal increases. Since the depth to coal increases, most stock and domestic wells are completed in units above the coal. Consequently, with the exception of CBNG wells, few wells are completed in the coal in the areas west of the mines. Those wells completed in the coal have considerable available drawdown, so it is unlikely that surface coal mining would cause adverse impacts on wells outside the immediate mine area.

Wells in the Wasatch Formation were predicted to be impacted by drawdown only if they were within 2,000 feet of a mine pit (Martin et al. 1988). Drawdown occurs farther from the mine pits in the coal than in the shallower aquifers because the coal is a confined aquifer that is already extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a 5-foot drawdown would be much smaller than the area of drawdown in the coal because the shallower aquifers are generally discontinuous, of limited areal extent, and often unconfined.

When the USGS CHIA was prepared, there were about 1,200 water supply wells within the maximum impact area defined in that study. Of those wells, about 580 were completed in Wasatch aquifers, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There were no completion data available for the remainder of the wells (about 240) at the time the USGS CHIA was prepared.

If a tract is leased and mined under one of the action alternatives, the groundwater drawdown would be extended into the area surrounding the proposed new leases. When a lease is issued to an existing mine for a maintenance tract, the mine must revise its existing mining permit to include the new tract in its mine and reclamation plans. In order to do that, the lessee would be required to conduct a detailed groundwater analysis to predict the extent of drawdown in the coal and overburden aquifers caused by mining the new lease. The WDEQ/LQD would use the revised drawdown predictions to update their cumulative hydrologic impact analysis for this portion of the PRB. The applicant has installed monitoring wells that would be used to confirm or refute drawdown predicted by analysis. This analysis would be required as part of the WDEQ mine permitting procedure discussed in sections 1.2 and 1.3.

Potential water-level decline in the subcoal Fort Union Formation is the third major groundwater issue. Water level declines in the Tullock Aquifer have been documented in the Gillette area.

According to Crist (1991), these declines are most likely attributable to pumpage for municipal use by Gillette and for use at subdivisions and trailer parks in and near Gillette. Most of the water-level declines in the subcoal Fort Union wells occur within 1 mile of the pumped wells (Crist 1991, Martin et al. 1988). Many of the mines have water supply wells completed in zones below the coal, but the mine facilities in the PRB are separated by a distance of 1 mile or more, so little interference between mine supply wells would be expected.

In response to concerns voiced by regulatory personnel, several mines have conducted impact studies of the subcoal Fort Union Formation. The OSM also commissioned a cumulative impact study of the subcoal Fort Union Formation to address the effects of mine facility wells on this aquifer (OSM 1984). Conclusions from these studies are similar and are summarized below.

- Because of the discontinuous nature of the sands in this formation and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.
- In the Gillette area, water levels in this aquifer have probably declined because the city of Gillette and several subdivisions have used water from the formation (Crist 1991). (Note: Gillette is mixing Fort Union Formation water with water from wells completed in the Madison Formation. Also, because drawdown has occurred, some operators are able to dispose of CBNG water by injecting it into the subcoal Fort Union Formation near the city of Gillette.)
- Because large saturated thicknesses are available (locally) in this aquifer unit, generally 500 feet or more, a drawdown of 100 to 200 feet in the vicinity of a pumped well would not dewater the aquifer.

Most of the existing coal mines in the PRB have permits from the Wyoming SEO for subcoal Fort Union Formation water supply wells. Two industrial water supply wells within Bucksin Mine's existing permit area are completed in the Fort Union Formation. Extending the life of the Buckskin Mine by issuing a new lease would result in additional water being withdrawn from the subcoal Fort Union Formation, but no new subcoal water supply wells would be required. The additional water withdrawal would not be expected to extend the area of water level drawdown over a substantially larger area because of the discontinuous nature of the sands in the Tullock Member and the fact that drawdown and yield reach equilibrium in a well due to recharge effects. Due to the distances separating subcoal Fort Union Formation wells used for mine water supply, these wells have not experienced interference and are not likely to in the future.

Water requirements and sources for proposed power plants are not currently known; however, there are no proposed power plants in the immediate vicinity of the Buckskin Mine. The Wyoming SEO is discouraging further development of the lower Fort Union Formation aquifers, so the most likely groundwater source for future power plants is the Lance-Fox Hills Aquifer System. This would reduce the chances that the power plants would add to cumulative hydrologic impacts of mining and CBNG production.

The fourth issue of concern with respect to groundwater is the effect of mining on water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the backfill aquifer following mining?

In a regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be higher in water from backfill aquifers than in water from either the Wasatch Formation overburden or the Wyodak coal aquifer (Martin et al. 1988). This is expected because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly from the overburden materials that were situated above the saturated zone in the premining environment.

One pore volume of water is the volume of water that would be required to saturate the backfill following reclamation. The time required for one pore volume of water to pass through the backfill aquifer is greater than the time required for the postmining groundwater system to reestablish equilibrium. According to the USGS CHIA, estimates of the time required to reestablish equilibrium range from tens to hundreds of years (Martin et al. 1988).

The major current use of water from the aquifers being replaced by the backfill (the Wasatch Formation overburden and Wyodak coal aquifers) is for livestock because these aquifers are typically too high in dissolved solids for domestic use and well yields are typically too low for irrigation (Martin et al. 1988). Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in backfill aquifers at 10 mines indicated that the quality of water in the backfill will, in general, meet the state standard for livestock use of 5,000 mg/L for TDS when recharge occurs (Martin et al. 1988).

The 2000 annual GAGMO report (Hydro-Engineering 2001b) evaluated samples from 48 backfill wells in 1999 and found that the TDS in 75% were less than 5,000 mg/L, TDS in 23% were between 5,000 and 10,000 mg/L, and TDS in one well was above 10,000 mg/L. An analysis of about 2,000 samples collected from 95 backfill monitoring wells between 1986 and 2002 found that the water quality in 75% of the wells were within the acceptable range for the Wyoming livestock standard, with 25% exceeding that standard (Ogle 2004).

The WDEQ/LQD calculated a median TDS concentration of 3,293 mg/L for the backfill aquifer in the east-central area of the PRB, which includes the four mines located immediately south of Gillette, based on 1,384 samples (Ogle et al. 2005). These results suggest that the TDS in the backfill aquifer in the middle group of mines meets the requirements for livestock use and is similar to TDS found in the undisturbed Wasatch Formation overburden but typically larger than TDS found in the Wyodak coal aquifer. Results from the Buckskin Mine indicated that overburden groundwater quality meets suitability criteria for livestock, but exceeds TDS and sulfate limits for domestic and irrigation uses (section 3.5.1.1). The GAGMO 25-Year Report (Hydro-Engineering 2007) reported samples collected from 57 backfill monitoring wells, and of the last samples that were collected from those wells in 2005, the TDS concentrations ranged from a low of 656 mg/L at well RW2804 (at the Belle Ayr Mine) to and high of 12,409 mg/L at well SP-4-NA (at the North Antelope Rochelle Mine), with an average of 3,800 mg/L and a median of 3,670 mg/L. The incremental effect on groundwater quality due to leasing and mining

the proposed tract or alternative tract configuration would be to increase the total volume of backfill and, thus, the time for equilibrium to reestablish.

The fifth area of concern is the potential for cumulative impacts on groundwater resources due to the proximity of coal mining and CBNG development. The Wyodak coal is being developed by mining and CBNG production in the same general area. Dewatering activities associated with CBNG development have overlapped with and expanded the area of groundwater drawdown in the coal aquifer in the PRB over what would occur due to coal mining development alone, and this would be expected to continue.

Numerical groundwater flow modeling was used to predict the impacts of the cumulative stresses imposed by mining and CBNG development on the Fort Union Formation coal aquifer in the PRB Oil and Gas Project EIS (BLM 2003). Modeling was necessary because of the large areal extent, variability, and cumulative stresses imposed by mining and CBNG development on the Fort Union coal aquifers. Information from earlier studies was incorporated into the modeling effort for this analysis.

As expected, the modeling indicated that the groundwater impacts from CBNG development and surface coal mining would be additive in nature. The addition of CBNG development would extend the area experiencing a loss in hydraulic head to the west of the mining area. The 20-year GAGMO report stated that drawdowns in all areas have greatly increased due to the water production from the Wyodak coal aquifer by CBNG producers (Hydro-Engineering 2001a).

Drawdowns in the coal caused by CBNG development would be expected to reduce the need for dewatering in advance of mining, which would be beneficial for mining operations. Wells completed in the coal may also experience increased methane emissions in areas of significant aquifer depressurization. There is a potential for conflicts to occur over who (coal mining or CBNG operators) is responsible for replacing or repairing private wells that are adversely affected by the drawdowns; however, the number of potentially affected wells completed in the coal is not large.

As discussed previously, state and federal law requires coal companies to mitigate any water rights that are interrupted, discontinued, or diminished by coal mining. In response to concerns about the potential impacts of CBNG development on water rights, a group of CBNG operators and local landowners developed a standard water well monitoring and mitigation agreement that can be used on a case-by-case basis as development proceeds. All CBNG operators on federal oil and gas leases are required to offer this water well agreement to the surface landowners (BLM 2003).

After CBNG development and coal mining projects are completed, it will take longer for groundwater levels to recover due to the overlapping drawdown impacts caused by the dewatering and de-pressuring of the coal aquifer by both operations.

4.2.4.2 Surface Water

For the PRB Coal Review Task 1B Report, which describes the baseline year (2003) water resource conditions including surface water use and surface water availability, the Wyoming PRB is divided into two major water planning areas: the Powder/Tongue River Basin and the Northeast Wyoming River Basins.

The main rivers in the Powder/Tongue River Basin are the Tongue River and the Powder River. The basin receives substantial surface water runoff from the Big Horn Mountains, leading to major agricultural development along drainages in the Tongue River and Powder River basins. Reservoirs are used throughout the basin for agricultural water supply and for municipal water supply in the Powder/Tongue River Basin. Water use in the Powder/Tongue River Basin as of 2002 is summarized in table 4-16.

The Little Bighorn River, Tongue River, Powder River, Crazy Woman Creek, and Piney Creek carry the largest natural flows in the Powder/Tongue River Basin. Many of the other major drainages are affected by irrigation practices to the extent that their flows are not natural (HKM Engineering et al. 2002a). Water availability in the major sub-basins of the Powder/Tongue River Basin is summarized in table 4-17. This table presents the amount of surface water in acre-feet that is physically available above and beyond allocated surface water in these drainages. As a result of the Yellowstone River Compact, Wyoming must share some of the physically available surface water in the Powder/Tongue River Basin with Montana.

Table 4-16. Water Use as of 2002 in the Powder/Tongue River Basin

Water Use Categories	Dry Year		Normal Year		Wet Year	
	(acre-feet per year)					
	Surface Water	Ground-water	Surface Water	Ground-water	Surface Water	Ground-water
Agricultural	178,000	200	184,000	200	194,000	300
Municipal	2,700	500	2,700	500	2,700	500
Domestic	---	4,400	---	4,400	---	4,400
Industrial[1]	---	68,000	---	68,000	---	68,000
Recreation	Non-consumptive					
Environmental	Non-consumptive					
Evaporation	11,300	--	11,300	--	11,300	--
Total	**192,000**	**73,100**	**198,000**	**73,100**	**208,000**	**73,200**

[1] Includes conventional oil and gas production water and CBNG production water.
Source: HKM Engineering et al. 2002a

Table 4-17. Surface Water Availability in the Powder/Tongue River Basin

Sub-basin	Surface Water Availability (acre-feet per year) Wet Years	Normal Years	Dry Years
Little Bighorn River	152,000	113,000	81,000
Tongue River	473,000	326,000	218,000
Clear Creek	213,000	124,000	80,000
Crazy Woman Creek	69,000	32,000	16,000
Powder River	547,000	324,000	16,000
Little Powder River	48,000	12,000	3,000
Total	**1,502,000**	**931,000**	**414,000**

Source: HKM Engineering et al. 2002a

The main rivers in the northeast Wyoming river basins are the Belle Fourche in Campbell and Crook counties and the Cheyenne River in Converse, Weston, and Niobrara counties. Water in these rivers and their tributaries comes from groundwater baseline flow and from precipitation, especially from heavy storms during the summer months. Water use in the northeast Wyoming river basins as of 2002 is summarized in table 4-18.

Table 4-18. Water Use as of 2002 in the Northeast Wyoming River Basins

Water Use Categories	Dry Year (acre-feet per year) Surface Water	Dry Year Ground-water	Normal Year Surface Water	Normal Year Ground-water	Wet Year Surface Water	Wet Year Ground-water
Agricultural	65,000	11,000	69,000	17,000	71,000	17,000
Municipal	---	9,100	---	9,100	---	9,100
Domestic	---	3,600	---	3,600	---	3,600
Industrial (Oil and Gas)[1]	---	46,000	---	46,000	---	46,000
Industrial (Other)[2]	---	4,700	---	4,700	---	4,700
Recreation			Non-consumptive			
Environmental			Non-consumptive			
Evaporation (Key Reservoirs)	14,000	---	14,000	---	14,000	---
Evaporation (Stockponds)	6,300	---	6,300	---	6,300	---
Total	**85,300**	**74,400**	**89,300**	**80,400**	**91,300**	**80,400**

1 Includes conventional oil and gas production water and CBNG production water.

2 Includes electricity generation, coal mining, and oil refining.

Source: HKM Engineering et al. 2002b

Stream flow in major drainages of the Northeast Wyoming River Basins is much less than in the Powder/Tongue River basin due to the absence of a major mountain range to provide snow melt

runoff. Water availability in the major sub-basins of the northeast Wyoming river basin is summarized in table 4-19.

Table 4-19. Surface Water Availability in the Northeast Wyoming River Basins

Sub-basin	Surface Water Availability (acre-feet per year) Wet Years	Normal Years	Dry Years
Redwater Creek	34,000	26,000	17,000
Beaver Creek	30,000	20,000	14,000
Cheyenne River	103,000	31,000	5,000
Belle Fourche River	151,000	71,000	13,000
Total	**318,000**	**148,000**	**49,000**

Source: HKM Engineering et al. 2002b

The portions of the PRB Coal Review Task 3B Report (BLM 2008g) that have been completed evaluate cumulative impacts on surface water quality as a result of CBNG, conventional oil and gas, and surface coal mining development in 2003, and projected development in 2010, 2015, and 2020 in that report's study area (map 4-2). The surface water resources in the PRB Coal Review Task 3 study area consist primarily of intermittent and ephemeral streams and scattered ponds and reservoirs. The projected development activities would have a direct impact on these surface water features. Table 4-10 summarizes the cumulative baseline (2003) and projected (in 2010, 2015, and 2020) acres of surface disturbance and reclamation. The projected activities would result in surface disturbance in each of the six Task 3 study area subwatersheds (map 4-2). Discrete locations for development disturbance and reclamation areas cannot be determined based on existing information. However, the projected disturbance would primarily involve the construction of additional linear facilities, product gathering lines, and road systems associated with conventional oil and gas and CBNG activities, plus additional disturbance associated with extending coal mining operations onto lands adjacent to the existing mines.

Surface-disturbing activities can increase sediment levels in local water bodies. This affects water quality parameters such as turbidity and bottom substrate composition. Contaminants also can be introduced into water bodies through chemical characteristics of the sediment. Studies have shown that TDS levels in streams near reclaimed coal mine areas have increased from 1% to 7% (Martin et al. 1988-- TDS levels in streams near reclaimed coal mine areas). Typically, sedimentation effects are short-term in duration and localized in terms of the affected area. Suspended sediment concentrations would stabilize and return to typical background concentrations after construction or development activities have been completed. It is anticipated that sediment input associated with development disturbance areas would be minimized by implementing appropriate erosion control measures, as would be determined during future permitting.

Future coal mining could remove intermittent or ephemeral streams and stockponds in the Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, and Antelope Creek

subwatersheds. As discussed in section 3.5.2, the Buckskin Mine is in the Little Powder River subwatershed. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988).

Coal mining-related surface water would be discharged into intermittent and ephemeral streams in four subwatersheds (Antelope Creek, Little Powder River, Upper Belle Fourche River, and Upper Cheyenne River). Based on current trends, it is assumed that most, if not all, of the coal mine-produced water would be consumed during operation. As discussed in section 3.5.2.2, changes in surface runoff would occur because of the destruction and reconstruction of drainage channels as mining progresses. Sediment control structures would be used to manage discharges of surface water from the mine permit areas. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards.

The PRB Coal Review assumes that future permitting would allow a portion of CBNG-produced water to be discharged to intermittent and ephemeral drainages as is currently allowed in the six subwatersheds in the PRB Coal Review Task 3 study area (map 4-2). It is estimated that up to 39,108, 41,899, and 37,390 million gallons per year of water would be produced in 2010, 2015, and 2020, respectively.

The PRB Coal Review Task 3B surface water quality impact analysis uses the surface water model described in the Surface Water Quality Analysis Technical Report (Greystone 2003), which was prepared in support of the PRB Oil and Gas Project EIS (BLM 2003), to evaluate the cumulative impacts on surface water resources from surface discharge of CBNG development. Based on past monitoring in receiving streams, most CBNG discharge water either infiltrates or evaporates within a few miles of the discharge points and generally is not recorded at USGS stream gauging stations. Impacts on surface water flow and quality are generally limited to within a few miles of the discharge point. In view of this, the PRB Coal Review Task 3B water quality impact analysis assumes a conveyance loss of 70% for the water quality assessment and modeling analysis.

Key water quality parameters for predicting the potential effects of CBNG development in the surface water quality impact analysis focused on the suitability of surface water for irrigated agriculture. Sodium adsorption ratio (SAR), and salinity, measured by electrical conductivity (EC), were used for this prediction. Most restrictive proposed limit (MRPL) and least restrictive proposed limit (LRPL) regulatory standards for EC and SAR applicable to the subwatersheds were developed and used in the analysis. The limits presented in table 4-20 were used during the comparison of EC and SAR valued for resulting mixtures of existing streamflows and discharges from CBNG wells under various flow conditions and the CBNG water discharge projections for 2010, 2015, and 2020.

Table 4-20. Summary of Proposed Limits for SAR and EC

	Most Restrictive Proposed Limit		Least Restrictive Proposed Limit	
Subwatershed	SAR	EC (µS/cm)	SAR	EC (µS/cm)
Little Powder	5	2,000	9.75	2,500
Powder	2	2,000	9.75	2,500
Belle Fourche	6	2,000	10	2,500
Cheyenne, Antelope Creek	10	2,000	10	2,500

SAR = sodium adsorption ratio; EC = electrical conductivity; µS/cm = micro siemens/centimeter

Source: Wyoming DEQ, Montana DEQ, and South Dakota Legislative Council

The impacts on water quality on the receiving drainages assumed two hydrologic conditions: dry year conditions and normal year conditions. The impact analysis, conducted using monthly flows, comparatively evaluated the water quality parameters (SAR and EC) of the receiving drainage before and after mixing with discharge water generated by the CBNG wells within that drainage. In general, the water discharged from the CBNG wells reflected increased levels of SAR and reduced levels of EC compared to the water quality of the receiving drainages. Impacts on water quality are likely to be maximized during the low flow months; consequently, the comparative evaluation of water quality also focused on the minimum monthly flow associated with the dry year and normal year conditions.

The water quality impact analysis made several observations regarding the overall effects of mixing CBNG well production water with surface water in the PRB Coal Review Task 3 study area. These general observations are summarized below.

Before mixing, the surface water in the Upper Powder River exceeds the MRPL for both EC and SAR throughout the majority of the year. Levels of SAR are less than the LRPL while EC values generally exceed the LRPL from July through December. After mixing, a minimal reduction in EC and a minor increase in SAR are projected, which reflects the relatively small contribution of CBNG well production water to the much larger flows in the Upper Powder River. Projected SAR values exceed the MRPL throughout the year while meeting the LRPL. Projected EC values exceed the MRPL throughout the majority of the year and the LRPL from July through December.

For Antelope Creek and the Dry Fork Cheyenne River under the before mixing scenario, the SAR values are relatively low and do not exceed the MRPL. The EC values exceed the MRPL during the low-flow months but are typically less than the LRPL all year. After mixing, SAR levels increase but are projected to continue to meet the MRPL and a reduction in EC is projected that meets the MRPL throughout the year. This is a reflection of the lack of surface water in these streams combined with the relatively low values for EC and SAR in the CBNG well production water.

Before mixing, the surface water in the Little Powder River exceeds the MRPL for EC and SAR throughout the majority of the year. SAR levels remain below the LRPL throughout the year, but EC levels exceed the LRPL during the low flow months. After mixing, the projected SAR

values exceed the MRPL throughout the year and exceed the LRPL from one month (in 2003) to five months (in 2010 and 2015) of the year. The projected EC exceeds the MRPL for four months of the year but meets the LRPL throughout the year.

For the Upper Cheyenne River before mixing, the SAR levels do not exceed the MRPL and the EC levels exceed the MRPL for eleven months of the year and the LRPL for nine months of the year. After mixing, the projected SAR levels continue to meet the MRPL throughout the year and the projected EC levels exceed the MRPL for 10 or more months of the year and the LRPL for six or more months of the year.

Before mixing, the surface water in the Upper Belle Fourche River exceeds the MRPL for SAR from November through January while meeting the LRPL throughout the year. The EC levels exceed the MRPL from September through January and exceed the LRPL from November through January. After mixing, the projected SAR values exceed the MRPL six or more months of the year while continuing to meet the LRPL throughout the year. The projected EC values meet the MRPL throughout the year.

The suitability of the mixed water for irrigation purposes is related to EC and SAR. In general, the water most suitable for irrigation has a relatively low SAR and a relatively high EC. Elevated SAR values may reduce permeability in clayey soils, which reduces the rate of water infiltration. As discussed above, the water discharged from the CBNG wells is generally characterized by higher levels of SAR and reduced levels of EC compared to the water quality of the receiving drainages. In those cases where mixing results in a significant increase in SAR and the EC is moderately low, the water was considered unsuitable. For Antelope Creek, the Dry Fork Cheyenne River, the Little Powder River, and the Upper Belle Fourche River, the projected water quality after mixing demonstrated adequate suitability for irrigation during normal year conditions and unsuitability for irrigation during some to all of the irrigation season during dry year conditions. In general, for periods where CBNG well production water represents the majority of the flow available for irrigation purposes, there is a reduction in the suitability of the water for irrigation purposes.

4.2.5 Channel Stability

A qualitative assessment of the impacts on receiving drainages resulting from the introduction of CBNG well production water was made. The channel of the Belle Fourche River below Moorcroft would change by less than 0.2%, while the channel of the Little Powder River near Weston would change by less than 0.3% (table 4-21). Given the low increase in mean annual discharge from introduced CBNG water, changes in channel geomorphology (width, depth, gradient, bed material transport and meander wavelength) are considered unnoticeable.

Table 4-21. Impact of CBNG Production Water on Perennial Streams

Location	Channel Forming Discharge[1] (cfs)	CBNG Discharge (cfs)	CBNG Discharge (%)	Estimated Width Existing Conditions (ft)	Estimated Width Combined Discharge (ft)	Potential Impact [Increased Width] (ft)	Potential Impact [Increased Width] (%)
Little Powder River above Dry Creek near Weston, Wyoming (USGS Gage 06324970)	270 to 420	2.2	0.5% to 0.8%	47.3 to 56.3	47.4 to 56.4	0.15 to 0.12	0.3%
Belle Fourche River below Moorcroft, Wyoming (USGS Gage 06426500)	652 to 789	3.9	0.5% to 0.6%	66.9 to 72.1	67.0 to 72.2	0.16 to 0.14	0.2%

CBNG = coal bed natural gas; cfs = cubic feet per second; ft = feet; USGS = U.S. Geological Survey

[1] Discharge associated with the 1.5 to 2 year recurrence interval.

Source: The PRB Coal Review Task 3B (BLM 2008h) surface water quality impact analysis uses the surface water model described in the Surface Water Quality Analysis Technical Report (Greystone Environmental Consultants, Inc. 2003)

Discharge of CBNG well production water into ephemeral drainages may start or exacerbate erosion in the channel. Given the potentially greater increase in the occurrence of ephemeral drainages due to a lower natural flow, channel geomorphology is more likely to be evident. Monitoring and mitigation for erosion are included in water management planning for oil and gas drilling approvals. Included in the BLM Task 3B Report (BLM 2008h), a special study was done of the Caballo Creek drainage in the Belle Ayr Mine permit area, to see how reclaimed drainages were impacted by increased CBNG discharges. It was determined that CBNG discharge represented less than 1% of the two-year peak discharge. No active erosion was noted in the natural or diverted portions of the Caballo Creek channel, while an increase in vegetative diversity and density was noted. The minor amount of flow increase would not likely result in increased erosion in streams similar to Caballo Creek. While it is more likely that creeks with smaller drainage areas, like Duck Nest or Bone Pile creeks may experience more erosion due to relatively larger flow increases from CBNG discharge, such effects were not observed in the field.

4.2.6 Alluvial Valley Floors

The identified AVFs for all coal mines in the PRB Coal Review study area are described in the PRB Coal Review Task 1D Report (BLM 2005e), and are based on individual mine state decision documents. Regulatory determinations of AVF occurrence and location are completed as part of the permitting process for coal mining operations, because their presence can restrict mining activities under SMCRA and Wyoming laws. The WDEQ/LQD administers the AVF regulations for coal mining activities in Wyoming. Coal mine related impacts on designated AVFs generally are not permitted if the AVF is determined to be significant to agriculture. If an AVF is determined not to be significant to agriculture or if the permit to affect the AVF was approved prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored to essential hydrologic function during reclamation.

The formal AVF designation and related regulatory programs described above are specific to coal mining operations; however, other development-related activities in the study area would potentially impact AVF resources. The portions of the PRB Coal Review Task 3 study area that lie outside of the mine permit areas have generally not been surveyed for the presence of AVFs; therefore, the locations and extent of the AVFs outside of the mine permit areas have not been determined. No AVFs are present in the general analysis area.

4.2.7 Soils

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on soils from projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-2 and table 4-3. The area of disturbance and reclamation for all development for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Development activities such as increased vehicle traffic, vegetation removal, soil salvage and redistribution, discharge of CBNG produced groundwater, and construction and maintenance of project-specific components (e.g., roads, ROWs, well pads, industrial sites, and associated ancillary facilities) would result in cumulative impacts on soils in the study area. In general, soil disturbance and handling from these activities would generate both long-term and short-term impacts on soil resources through accelerated wind or water erosion, declining soil quality factors, compaction, and the temporary and, in some instances, the essentially permanent removal of soil resources at industrial sites.

Of the types of development projects in the study area, coal mining activities would create the most concentrated cumulative impacts on soils. This is due to the large acreages involved and the tendency of mining operations to occur in contiguous blocks. These factors would encourage widespread accelerated wind and water erosion. Extensive soil handling would cause compaction and a corresponding loss of permeability to water and air; a decline in microbial populations, fertility, and organic matter; and potential mixing of saline and alkaline soil zones into seedbeds, which would reduce soil quality. There would be a limited availability of suitable soil resources for reclamation uses in some areas.

However, for surface coal mining operations, there are measures that are either routinely required or can be specifically required as necessary to reduce impacts on soil resources and to identify overburden material that may be unsuitable for use in reestablishing vegetation, as discussed in sections 3.3.1.3, 3.4.2.3, and 3.8.3.

As described in appendix E of the PRB Coal Review Task 2 Report (BLM 2005b), a variety of CBNG water disposal methods may be employed in the Task 3 study area. The potential impacts on soils would depend on the water treatment method, if any, and the nature of the disposal method. As discussed in the PRB Coal Review Task 3D Report (BLM 2005f), due to elevated SAR levels in water produced from the Wyodak-Anderson coal zone in the Upper Powder River

and Little Powder River subwatersheds, land applications of CBNG-produced water in those areas could increase soil alkalinity. As discussed above in section 4.2.4.2, the SAR values are generally low for the Little Powder River subwatershed and tend to exceed the MRPL after mixing with discharged CBNG water throughout the year and exceed the LRPL from one to five months of the year. Land application of CBNG-produced water is not anticipated in this area. The specific approaches to CBNG water discharges, the resource conditions and locations in which they occur, the timing of discharges, and the discharge permit stipulations from regulatory and land management agencies would determine the extent and degree of potential impacts on soils.

4.2.8 Vegetation, Wetlands and Riparian Areas

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on vegetation, wetlands, and riparian areas from projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 related to surface coal mining are shown in table 4-2 and table 4-3. For all projected development, the baseline year area of disturbance and reclamation and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

4.2.8.1 Vegetation

The PRB is characterized as a mosaic of general vegetation types, including prairie grasslands, shrublands, forested areas, and riparian areas. These broad categories often represent several vegetation types that are similar in terms of dominant species and ecological importance. Fourteen vegetation types were identified within the PRB Coal Review Task 1 study area, of which 10 primarily consist of native vegetation and are collectively classified as rangeland. These vegetation types include short-grass prairie, mixed-grass prairie, sagebrush shrubland, other shrubland, coniferous forest, aspen, forested riparian, shrubby riparian, herbaceous riparian, and wet meadow. The remaining vegetation types support limited or non native vegetation and include cropland, urban/disturbed, barren, and open water. The vegetation types are described in more detail in the Task 1D Report for the PRB Coal Review (BLM 2005e).

Impacts on vegetation can be short-term and long-term. Potential short-term impacts arise from removing and disturbing herbaceous species during a project's development and operation (e.g., coal mining, CBNG drilling and production, etc.), which would cease upon project completion and successful reclamation in a given area. Reclaimed mine land is defined by the WDEQ/LQD as affected land that has been backfilled, graded, topsoiled, and permanently seeded in accordance with the approved practices specified in the reclamation plan (Christensen pers. comm.). Species composition on the reclaimed lands may be different than on the surrounding undisturbed lands. The removal of woody species would be considered a long-term impact since these species take approximately 25 years or longer to attain a size comparable to woody species present within proposed disturbance areas. Potential long-term impacts would

also include permanent loss of vegetation and vegetative productivity in areas that would not be reclaimed in the near term (e.g., power plant sites, etc.).

4.2.8.2 Special Status Plant Species

Special status plant species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are protected under the ESA), BLM sensitive species, USDA-Forest Service sensitive species, and WGFD species of special concern in Wyoming. No USDA-Forest Service administered lands are located in the general analysis area. Species protected under the ESA, as well as BLM sensitive species, are discussed further in appendices I and J of this EIS. Two federally listed plant species (Ute ladies'-tresses orchid and blowout penstemon) and three USDA Forest Service sensitive species (Barr's milkvetch, rosy palafox, and lemonscent) are known to occur in the PRB Coal Review Task 3 study area. Three BLM sensitive speciesmay occur in the PRB Coal Review Task 3 study area: Nelson's milkvetch, Laramie columbine (Casper Field Office), and William's wafer-parsnip (Buffalo Field Office).

Potential direct impacts on special status plant species in the study area could include the incremental loss or alteration of potential or known habitat associated with past and projected activities. Direct impacts also could include the direct loss of individual plants within the PRB Coal Review Task 3 study area, depending on their location in relation to development activities. Indirect impacts could occur due to increased dispersal and establishment of noxious weeds, which may result in the displacement of special status plant species in the long term.

4.2.8.3 Noxious and Invasive Weed Species

Once established, invasive and non-native plant species can out-compete and eventually replace native species, thereby reducing forage productivity and the overall vigor and diversity of existing native plant communities. The State of Wyoming has designated the following 25 plant species as noxious weeds:

- Field bindweed (*Convolvulus arvensis*)
- Canada thistle (*Cirsium arvense*)
- Leafy spurge (*Euphorbia esula*)
- Perennial sowthistle (*Sonchus arvensis*)
- Quackgrass (*Agropyron repens*)
- Hoary cress (*Cardaria draba*)
- Perennial pepperweed (giant whitetop) (*Lepidium latifolium*)
- Ox-eye daisy (*Chrysanthemum leucanthemum*)
- Skeletonleaf bursage (*Franseria discolor Nutt.*)

- Russian knapweed (*Centaurea repens L.*)
- Yellow toadflax (*Linaria vulgaris*)
- Dalmatian toadflax (*Linaria dalmatica*)
- Scotch thistle (*Onopordum acanthium*)
- Musk thistle (*Carduus nutans*)
- Common burdock (*Arctium minus*)
- Plumeless thistle (*Carduus acanthoides*)
- Dyers woad (*Isatis tinctoria*)
- Houndstongue (*Cynoglossum officinale*)
- Spotted knapweed (*Centaurea maculosa Lam.*)
- Diffuse knapweed (*Centaurea diffusa Lam.*)
- Purple loosestrife (*Lythrum salicaria L.*)
- Saltcedar (*Tamarix spp.*)
- Common St. Johnswort (*Hypericum perforatum*)
- Common Tansy (*Tanacetum vulgare*)
- Russian olive (*Elaeagnus angustifolia L.*)

Campbell County does not have a declared list of noxious weeds.

Development-related construction and operation activities would potentially result in the dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, resulting in displacement of native species and changes in species composition in the long term. The potential for these impacts would be higher in relation to the development of linear facilities (e.g., pipeline right-of-ways, oil- and gas-related road systems, etc.) than for site facilities (e.g., mines, power plants, etc.) due to the potential for dispersal of noxious weeds over a larger area.

Chapter 4, section 2(d)(xiv) of the WDEQ/LQD rules and regulations requires that surface coal mines address weed control on reclaimed areas as follows:

> The operator must control and minimize the introduction of noxious weeds in accordance with Federal and State requirements until bond release.

Accordingly, the reclamation plans for all surface coal mines in the Wyoming PRB include steps to control invasion by weedy (invasive nonnative) plant species. As discussed in section 3.9.4, the Buckskin Mine works with the Campbell County Weed and Pest Department and conducts an active noxious weed control program on their existing coal leases. Similar measures to identify and control noxious weeds are used at all of the surface coal mines in the Wyoming PRB as a result of the WDEQ/LQD regulatory requirements.

Mitigation to control invasion by noxious weeds for CBNG developers is determined on a site-specific basis and may include spraying herbicides before entering areas and washing vehicles before leaving infested areas. BLM reviews weed educational material during preconstruction on-site meetings with CBNG operators, subcontractors, and landowners. BLM also attaches this educational information to approved applications for permit to drill or plans of development (BLM 2003). BLM also participates in a collaborative effort with the South Goshen Cooperative Extension Conservation District, the USDA-Natural Resources Conservation Service, private surface owners, WGFD, and the Campbell County Weed and Pest District in a prevention program that includes a long-term integrated weed management plan, public awareness and prevention programs, and a common inventory (BLM 2003).

4.2.8.4 Wetland and Riparian Species

Operations associated with development activities in the study area would result in the use of groundwater. Annually, during 2010-2020, from 30,000-35,000 million gallons per year of CBNG-produced water would be discharged to impoundments or intermittent and ephemeral streams or reinjected. The discharge of produced water could result in the creation of wetlands in containment ponds, landscape depressions, and riparian areas along segments of drainages that previously supported upland vegetation. In addition, existing wetlands and riparian areas that would receive additional water would become more extensive and potentially support a greater diversity of wetland species in the long term. Alternately, the discharge of abnormally high flows or water with SAR values of 13 or more could impact existing vegetation as discussed in the Task 1D Report for the PRB Coal Review (BLM 2005e). For agricultural uses, the current Wyoming water quality standard for SAR is 8.0 (WDEQ/WQD 2005). SAR values of 5 to 10 were observed in discharge waters in the study area (BLM 2003). Once water discharges have peaked and subsequently decrease in the long term, the extent of wetlands and riparian areas and species diversity would decrease accordingly. After the complete cessation of water discharges, artificially-created wetland and riparian areas once again would support upland species, and previously existing wetland and riparian areas would decrease in areal extent.

4.2.9 Wildlife and Fisheries

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on wildlife from projected development activities in the PRB Coal Review Task 3 study area. The area of habitat disturbance and reclamation related to surface coal mining for the baseline year (2003) and the projected cumulative areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. The baseline year area of total habitat disturbance and reclamation and the projected cumulative total areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Impacts on wildlife can be short-term and long-term. Potential short-term impacts arise from habitat disturbance associated with a project's development and operation (coal mines, CBNG wells, etc.) and would cease upon project completion and successful reclamation in a given area. Potential long-term impacts consist of long-term or permanent changes to habitats and the

wildlife populations that depend on those habitats, irrespective of reclamation success, and habitat disturbance related to longer term projects (power plant facilities, rail lines, etc.). Direct impacts on wildlife populations from development activities in the study area could include direct mortalities, habitat loss or alteration, habitat fragmentation, or animal displacement. Indirect impacts could include increased noise, additional human presence, and the potential for increased vehicle-related mortalities.

Habitat fragmentation from activities such as roads, well pads, mines, pipelines, and electrical power lines also can result in the direct loss of potential wildlife habitat. Other habitat fragmentation effects such as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition from unpaved road traffic can extend beyond the surface disturbance boundaries. These effects result in overall changes in habitat quality, habitat loss, increased animal displacement, reductions in local wildlife populations, and changes in species composition. However, the severity of these effects on terrestrial wildlife would depend on factors such as sensitivity of the species, seasonal use, type and timing of project activities, and physical parameters (topography, cover, forage, and climate).

4.2.9.1 Game Species

Big game species that are present within the Task 3 study area include pronghorn, white-tailed deer, mule deer, and elk. Potential direct impacts on these species would include the incremental loss or alteration of forage and ground cover associated with construction and operation of the past, present, and reasonably foreseeable future development discussed in section 4.1. Development associated with coal mining, drilling for CBNG, ancillary facilities, agricultural operations, urban areas, and transportation and utility corridors result in vegetation removal. Assuming that adjacent habitats would be at or near carrying capacity and considering the variabilities associated with drought conditions and human activities in the study area, the PRB Coal Review Task 3D study concluded that displacement of big game as a result of development activities would create some unquantifiable reduction in wildlife populations.

A number of big game habitat ranges have been defined within the PRB Coal Review Task 3 study area. In Wyoming, the WGFD and the BLM have established habitat classifications based on seasonal use. Classification types include crucial winter, severe winter, winter yearlong, and yearlong. Crucial winter range areas are essential in determining a game population's ability to maintain itself at a certain level over the long term. As discussed in the PRB Coal Review Task 2 Report, discrete locations for most of the disturbance related to the projected development could not be determined based on the available information. However, identified future coal reserves were used for the Task 3D Report to provide some level of quantification of potential future impacts on big game ranges. Tables 4-22 through 4-25 summarize the effects on pronghorn, deer, and elk game ranges from the predicted lower and upper levels of coal production through 2020.

Table 4-22. Potential Cumulative Disturbance to Pronghorn Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected)

	Pronghorn Ranges[1]			
Time Period/Scenario	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	1,472 / 3%	33,196 / 2%	32,099 / 1%
2010/Upper	N/A	1,472 / 3%	34,760 / 2%	33,172 / 1%
2015/Lower	N/A	1,460 / 3%	32,649 / 2%	34,828 / 1%
2015 Upper	N/A	1,460 / 3%	34,177 / 2%	36,999 / 1%
2020/Lower	N/A	1,422 / 3%	33,637 / 2%	35,714 / 1%
2020/Upper	N/A	1,422 / 3%	33,580 / 2%	37,437 / 2%

[1] Potential coal mine related impacts on big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-23. Potential Cumulative Disturbance to White-tailed Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected)

	White-tailed Deer Ranges[1]			
Time Period/Scenario	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	N/A	N/A	1,411 / 0.6%
2010/Upper	N/A	N/A	N/A	1,411 / 0.6%
2015/Lower	N/A	N/A	N/A	1,497 / 0.7%
2015 Upper	N/A	N/A	N/A	1,495 / 0.7%
2020/Lower	N/A	N/A	N/A	1,704 / 0.7%
2020/Upper	N/A	N/A	N/A	1,707 / 0.8%

[1] Potential coal mine-related impacts on big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-24. Potential Cumulative Disturbance to Mule Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected)

	Mule Deer Ranges[1]			
Time Period/Scenario	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	NA	NA	6,808 / 0.4%	25,390 / 1%
2010/Upper	NA	NA	6,924 / 0.4%	26,641 / 1%
2015/Lower	NA	NA	6,956 / 0.4%	26,420 / 1%
2015 Upper	NA	NA	7,285 / 0.5%	27,205 / 1%
2020/Lower	NA	NA	6,958 / 0.4%	27,004 / 1%
2020/Upper	NA	NA	7,413 / 0.5%	27,990 / 1%

[1] Potential coal mine-related impacts on big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-25. Potential Cumulative Disturbance to Elk Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected)

	Elk Ranges[1]			
Time Period/Scenario	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2010/Upper	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2015/Lower	24 / 0.4%	N/A	351 / 1%	1,161 / 0.7%
2015 Upper	24 / 0.4%	N/A	351 / 1%	1,162 / 0.7%
2020/Lower	24 / 0.4%	N/A	351 / 1%	1,121 / 0.7%
2020/Upper	24 / 0.4%	N/A	351 / 1%	1,168 / 0.7%

[1] Potential coal mine-related impacts on big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Direct and indirect effects to small game species (i.e., upland game birds, waterfowl, small game mammals) within the Task 3 study area as a result of development activities would be the same as discussed above for big game species. Impacts would result from the incremental surface disturbance of potential wildlife habitat, increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic.

Operations associated with development activities in the Task 3 study area would result in the use of groundwater. The PRB Coal Review assumes that most, if not all, of the coal mine-produced water would be consumed during operation and anticipates that up to

approximately 39,108, 41,484, and 37,350 million gallons per year of water would be produced in association with oil and gas production in 2010, 2015, and 2020, respectively. The portion of the water that is produced in association with the CBNG and discharged to impoundments or intermittent and ephemeral streams would be available for area wildlife (e.g., waterfowl). Although much of the water would evaporate or infiltrate into the ground, it is anticipated that substantial quantities of water would remain on the surface and would result in the expansion of wetlands, stockponds, and reservoirs, potentially increasing waterfowl breeding and foraging habitats. The median sodium concentration of CBNG-produced water from the Fort Union Formation is 270 mg/L. If sodium concentrations are maintained below 17,000 mg/L in the evaporation ponds, the potential adverse effects to waterfowl would be minimal.

4.2.9.2 Non-game Species

Potential direct impacts on non-game species (e.g., small mammals, raptors, passerines, amphibians, and reptiles) would include the incremental loss or alteration of existing or potential foraging and breeding habitats from construction and operation of past, present, and reasonably foreseeable future development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts also could result in mortalities of less mobile species (e.g., small mammals, reptiles, amphibians, and invertebrates), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, dispersal and invasion of noxious weeds, and dust effects from unpaved road traffic. Assuming that adjacent habitats would be at or near carrying capacity, and considering variable factors such as drought conditions and human activities in the study area, the PRB Coal Review concluded that displacement of wildlife species from the Task 3 study area would result in an unquantifiable reduction in wildlife populations.

Numerous migratory bird species have been documented within the PRB over the last two to three decades of wildlife monitoring. Development activities that occur during the migratory bird breeding season (April 1 through July 31) could cause the abandonment of a nest site or territory or the loss of eggs or young, resulting in the loss of productivity for the breeding season. Loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of the Migratory Bird Treaty Act and could potentially affect populations of important migratory bird species that may occur in the PRB. All surface coal mines in the Wyoming PRB are required to conduct annual surveys for migratory bird species of management concern in Wyoming; all mines also must have USFWS-approved monitoring and mitigation plans in place for these species.

Raptor species that regularly nest within the Task 3 study area include the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, American kestrel, northern harrier, great horned owl, short-eared owl, and burrowing owl. Bald eagles, prairie falcons, merlins, and long-eared owls (*Asio otus*) are rare nesters in the area. Rough-legged hawks are common winter residents, but breed in the arctic regions.

One potential direct impact on raptors is habitat (active nest site and foraging) loss due to additional surface disturbance within the Task 3 study area. In the event that development activities were to occur during the breeding season (February 1 through July 31), these activities could result in nest or territory abandonment, or loss of eggs or young. Such losses would reduce productivity for the affected species during that breeding season. As discussed above, loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of several laws, including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Efforts to minimize impacts on nesting raptors are addressed in each mine's USFWS-approved avian monitoring and mitigation plan.

Additional direct impacts could result from construction of new overhead power lines in the region. New power line segments in the study area would incrementally increase the collision and/or electrocution potential for migrating and foraging bird species (e.g., raptors and waterfowl) (Avian Power Line Interaction Committee 2006). However, the potential for avian collisions with overhead power lines depends on variables such as the location of the structures relative to high-use areas (e.g., nesting, foraging, staging, and roosting habitats), the orientation of the power line to flight patterns and movement corridors, species composition, line visibility, and structure design. Few collisions have been reported in the Task 3 study area due to the limited presence of perennial water bodies and other features that would attract large numbers of migrating waterfowl or other vulnerable species.

In addition, new power lines could pose an electrocution hazard for raptor species attempting to perch on the structure. Configurations greater than 69 kilovolts typically do not present an electrocution potential, based on conductor placement and orientation (Avian Power Line Interaction Committee 2006). Most, if not all, surface coal mines in the Task 3 study area use raptor-safe designs for all new overhead construction; many mines have retrofitted existing lines to make them safer for perching birds. In addition, the primary rural utility service cooperative in the region has voluntarily adopted an Avian Protection Plan that requires all new construction to be built to meet or exceed current recommendations by the Avian Power Line Interaction Committee. Future permitting for power lines may require the use of appropriate raptor-deterring designs for areas where they are not already in use, thereby minimizing potential impacts. For example, SMCRA requires that surface coal mine operators use the best technology available to ensure that electric power lines are designed and constructed to minimize electrocution hazards to raptors. Power line impacts on raptors can be reduced with the increased use of underground power lines wherever possible. Many of the power lines for CBNG development currently are being constructed underground; that option is not technically feasible for many projects due, in part, to the distance between the power source and the end user.

4.2.9.3 Fisheries

Potential cumulative effects on fisheries from of development activities in the Task 3 study area would be closely related to impacts on ground and surface water resources. In general, development activities could affect fish species in the following ways: 1) alteration or loss of habitat as a result of surface disturbance; 2) changes in water quality as a result of surface

disturbance or introduction of contaminants into drainages; and 3) changes in available habitat as a result of water withdrawals or discharge. The potential effects of development activities on aquatic communities are discussed below for each of these impact topics.

The predominant aquatic habitat type in the Task 3 study area consists of intermittent and ephemeral streams and scattered ponds and reservoirs. In general, perennial streams within the study area are limited to the Little Powder River and Belle Fourche River. Warm water game fish and non-game species are present in some perennial stream segments and numerous scattered reservoirs and ponds. However, the latter features are typically stocked artificially either following construction or annually, depending on the depth of the water body. Due to the lack of constant water in most of the potentially affected streams and static water bodies, existing aquatic communities are mainly limited to invertebrates and algae that can persist in these types of habitats. The removal of stockponds would eliminate habitat for invertebrates and possibly fish species. This loss would be temporary if the stockponds were replaced during reclamation.

Development activities could result in the loss of aquatic habitat as a result of direct surface disturbance. Table 4-10 summarizes the cumulative acres of surface disturbance and reclamation as of 2003 and projects cumulative acres of surface disturbance and reclamation in 2010, 2015, and 2020. Discrete locations for development disturbance and reclamation areas cannot be determined based on existing information. However, projected development that could result in the loss of aquatic habitat would involve construction of additional linear facilities, product gathering lines and road systems associated with conventional oil and gas and CBNG activities, as well as any additional disturbance associated with extending coal mine operations onto lands adjacent to the existing mines. The removal of aquatic habitat eliminates existing and potential habitat for invertebrates and some fish species. This loss would be temporary if such ponds are reconstructed and recharged as part of the reclamation process.

Projected activities would result in surface disturbance in each of the six Task 3 study area subwatersheds. Information relative to the stream crossing locations for the majority of the linear facilities is not available at this time. The initial phases of the proposed Bison Pipeline project commenced in April 2008 and is projected to be completed by November 2010. If the project is constructed as planned, it would cross Cottonwood Creek, a tributary of the Little Powder River. Typically, the associated disturbance corridor would consist of a 100-foot-wide construction ROW; however, site-specific stream crossing methods and reclamation would be determined at the time of project permitting.

Future coal mining also could remove intermittent or ephemeral streams and stockponds in the Antelope Creek, Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River subwatersheds, though not necessarily the streams themselves. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988). As discussed in section 3.5.2, the Little Powder River and its tributaries drain the existing Buckskin Mine permit area and the general analysis area. All streams in and adjacent to the general analysis area are typical for the region, in that flow events are ephemeral. Under natural

conditions, aquatic habitat is limited by that ephemeral nature of surface waters in the general analysis area.

The PRB Coal Review assumes that surface-disturbing activities would not be allowed in perennial stream segments or reservoirs on public lands that contain game fish species. It also assumes that other types of development operations would not occur within stream channels nor would they remove ponds or reservoirs as part of construction or operation and, therefore, would not result in the direct loss of habitat for these species.

Water quality parameters such as turbidity and bottom substrate composition can be impacted by surface disturbing activities through erosion of sediment into water bodies. Contaminants can also be introduced into those systems through the chemical characteristics of the eroded sediment. Potential related effects on aquatic biota could include physiological stress, movement to avoid affected areas, or alterations of spawning or rearing areas (Waters 1995). Studies have shown that TDS levels in streams near reclamation at surface coal mines have increased from 1% to 7% (Martin et al. 1988). Typically, sedimentation effects are short-term and localized in terms of the affected area. TDS concentrations would stabilize and return to more typical concentrations after construction or development activities have been completed. The PRB Coal Review anticipated that the use of appropriate erosion and spill control measures during both development and reclamation activities, as determined during the permitting process, would minimize the introduction of additional sediments into the subwatershed.

The removal of streamside vegetation would impact both riparian vegetation and stream parameters in those locations. Loss of vegetation along stream channels would reduce the shade and increase bank erosion, both of which would degrade aquatic habitats. Effects on aquatic habitats from linear projects, such as ROWs, would be limited to a relatively small portion of the stream (generally no more than 100 feet in width), whereas mine-related disturbance could affect considerably larger stretches. Because perennial streams are protected from development by a buffer zone on either side of center, these types of impacts would presumably be limited to intermittent and ephemeral creeks. It is anticipated that reclamation practices to restore riparian vegetation would be required during future project permitting, thereby minimizing such impacts.

CBNG and coal mining are the primary types of development activities that use or manage water as part of their operations. Based on current trends, the PRB Coal Review assumes that most, if not all, of the water produced during coal mining would be consumed during operation. As discussed in section 3.5.2.2, changes in surface runoff characteristics and sediment discharges would occur during surface coal mining from the destruction and reconstruction of drainage channels as mining progresses, and the use of sediment control structures to manage discharges of surface water from the mine permit area. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards. After treatment, coal mine-related surface water in the region would ultimately be discharged into intermittent and ephemeral streams in four subwatersheds (Antelope Creek, Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River). The PRB Coal Review projects that up to approximately 39,108, 41,484, and 37,350 million gallons per year of water would be produced in association

with oil and gas production in 2010, 2015, and 2020, respectively. The review also assumes that a portion of the water that is produced in association with the CBNG would be discharged to intermittent and ephemeral drainages in the general analysis area as is currently allowed in the six subwatersheds in the study area. Based on past monitoring in receiving streams, no change in surface flows would be expected beyond approximately 2 miles from the discharge points (BLM 2003). Water discharged from CBNG wells has supplied some drainages and water bodies in the PRB nearly continuously for several years. Within the general analysis area, Spring Creek has experienced an influx of CBNG water in recent years but has not become perennial. The same is true for other streams elsewhere in the PRB that receive CBNG discharge water.

4.2.9.4 Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are protected under the ESA), BLM sensitive species, USDA-Forest Service sensitive species, and WGFD species of special concern in Wyoming. No USDA-Forest Service administered lands are present in the general analysis area. Species that are protected under the ESA, as well as BLM sensitive species, are further discussed in appendices I and. The USFWS also has a list of migratory bird species of management concern for surface coal mines in Wyoming, which is discussed in section 3.10. Special status species potentially occurring in the Task 1 study area are identified in section 2.4.3.5 of the PRB Coal Review Task 1D Report (BLM 2005e). Additional information about the occurrence of these species in the general analysis area is contained in the annual wildlife reports for the Buckskin Mine, on file with the Sheridan, Wyoming office of the WDEQ/LQD.

Potential impacts on special status terrestrial species would be similar to those discussed above for non-game wildlife (e.g., small mammals, birds, amphibians, and reptiles). Potential direct impacts would include the incremental loss or alteration of potential habitat (native vegetation and previously disturbed vegetation) from construction and operation of development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts could also result in mortalities of less mobile species (e.g., small mammals, reptiles, and amphibians), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, introduction and dispersal of noxious weeds, and dust effects from unpaved road traffic.

In general, direct and indirect impacts on special status species would result in a reduction in habitat suitability and overall carrying capacity for species currently inhabiting the PRB Coal Review Task 3 study area. Development within potential habitat for special status species likely would decrease its overall suitability, and potentially would reduce or preclude use by some species due to increased activity and noise. Future use by a special status species of habitats subject to development would be strongly influenced by the quality and composition of remaining habitat, with the degree of impact dependent on variables such as breeding phenology, nest and den site preferences, the species' relative sensitivity to disturbance, and possibly the

presence of visual barriers (e.g., topographic shielding) between nesting efforts and disturbance activities.

Bird species that have been identified as occurring within the PRB and are on two or more of the special status species lists include the common loon (*Gavia immer*), American bittern (*Botaurus lentiginosus*), white faced ibis (*Plegadis chihi*), trumpeter swan (*Cygnus buccinator*),sandhill crane (*Grus canadensis*), mountain plover, upland sandpiper, long-billed curlew, black tern (*Chlidonias niger*), yellow-billed cuckoo (*Coccyzus americanus*), Lewis' woodpecker (*Melanerpes lewis*), pygmy nuthatch (*Sitta pygmaea*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike, Baird's sparrow (*Ammodramus bairdii*), sage sparrow (*Amphispiza belli*), Brewer's sparrow, and greater sage-grouse. Only the Brewer's sparrow, sage-grouse, upland sandpiper, long-billed curlew, loggerhead shrike, and sage thrasher (one sighting) have been documented at the Buckskin Mine during 25 years of annual monitoring. Only the Brewer's sparrow is seen with any regularity, and those observations typically occur in a sagebrush stand approximately 1.5 miles south of the general analysis area. Any development activities (oil and gas, coal mining, other operations and associated infrastructure) that occur during the breeding season (April 1 through July 31) could result in the abandonment of a nest site or territory, or the loss of eggs or young. As discussed previously, loss of an active nest site, incubating adults, eggs, or young from any of these development activities would not comply with the intent of the Migratory Bird Treaty Act and could potentially impact populations of important migratory bird species that are known to or may occur in the PRB.

A number of raptor species have been documented in the PRB and are on two or more of the special status species lists including the bald eagle, ferruginous hawk, northern goshawk, merlin, peregrine falcon, western burrowing owl, and short-eared owl. Species that have been documented in the general analysis area are discussed at length in section 3.10.5, with additional information in appendix J. Potential direct impacts on raptors would result from the surface disturbance of nesting and foraging habitat, as well as injury or mortalities due to collisions with vehicles and equipment. Nesting raptors in or adjacent to development activities could abandon their nest sites or territories, or lose eggs or young. As previously described, such losses would constitute non-compliance with the intent of laws such as the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The implementation of USFWS-approved avian monitoring and mitigation plans at surface coal mines in the Task 3 study area has minimized impacts on nesting raptors over the years. Any impacts that could occur would likely be limited to individual pairs and, thus, are not likelyto affect populations of migratory bird species that are known to or may occur within the region. Incremental construction of new overhead power lines in the area to support energy industries would increase risks of electrocution and collision for perching, migrating, and foraging bird species such as the larger raptors. Use of current Avian Power Line Interaction Committee guidelines for new construction designs and retrofitting measures for existing utility structures would help mitigate these impacts.

At least 477 greater sage-grouse strutting grounds (leks) were identified in the six subwatersheds in the PRB Coal Review Task 3 study area through 2008, though not all leks are counted every year (WGFD 2008b). As discussed in section 3.10 and in the PRB Coal Review Task 1D

Report, the trend in the sage-grouse population for the Sheridan region suggests about a 10-year cycle with periodic highs and lows. More recent population peaks have been lower than previous highs, suggesting a steadily declining sage-grouse population with the Sheridan region (WGFD 2008b). Direct and indirect impacts on sage-grouse from development activities would result from the incremental surface disturbance of existing and potential habitat, increased levels of noise and human presence, introduction or dispersal of noxious and invasive weed species, and effects of dust from increased traffic on unpaved roads. In addition to disturbance-related impacts, sage-grouse are susceptible to infection with West Nile virus. The incidence of infection from this disease has been much higher in northeast Wyoming than the rest of the state in the past, though fewer cases have been reported in recent years.

Based on results from annual counts and lek searches conducted for the Buckskin Mine since 1984, sage-grouse occur but are not abundant in the general analysis area (section 3.10.6). Three sage-grouse leks have been identified in the general analysis area. One of those three sites is classified by the WGFD as historical (abandoned) due to its consistent lack of use over the last 16 consecutive years.The remaining two leks have also been inactive in recent years, but are still classified as occupied by the WGFD. The Hay Creek sage-grouse lek is within the existing Buckskin Mine permit area, approximately 0.5 mile southeast of the general analysis area. This site has been or will be affected by previously permitted disturbance in the permit area. The McGee sage-grouse lek is approximately 1.25 miles north of the general analysis area, on the far side of multiple ridgelines. Two displaying males and three hens were seen at the Hay Creek lek on one morning in 2001, but no grouse were present during subsequent checks that year, or in any year since then. The McGee sage-grouse lek is located beyond the required annual monitoring area for the Buckskin Mine and, therefore, is not included in that monitoring program. A WGFD biologist first recorded the lek in 2001. Three displaying males were observed at the McGee sage-grouse lek in 2004. No grouse have been recorded at that lek since then, but it was not monitored every year.

If the proposed tract or an alternative tract configuration is leased and mined, potential nesting habitat for grouse that were bred at those leks would be affected by mining activity in those areas. However, as discussed in section 3.10.5.2, no sage-grouse nests or broods have been encountered in the general analysis area during specific surveys or incidental to other wildlife surveys conducted there annually since at least 1984. The noise associated with mining operations may also disrupt sage-grouse breeding and nesting activities that might occur in the area. Direct and indirect effects on greater sage-grouse within the general analysis area from development activities are outlined in section 3.10.6.

Based on existing information, the spatial relationship between projected future disturbance and reclamation areas for the coal production scenarios and the resource-specific information in the GIS layers could not be determined for the PRB Coal Review. However, the analysis did use GIS layers for future coal reserves to provide some quantification of potential future coal mining-related impacts on greater sage-grouse. The results of this analysis are summarized in table 4-26. The difference in the number of lek sites that would occur within 2 miles of coal mining activities under the lower coal production scenario versus the upper coal production

scenario is due to slight variations in the projected disturbance areas. An unquantifiable number of lek sites initially could be impacted by CBNG activity, which would occur in advance of coal mine development. Potential direct impacts on sage-grouse, if present, could include loss of foraging areas, abandonment of a lek site, or loss of eggs or young as a result of development activities.

Table 4-26. Potential Cumulative Impacts on Greater Sage-grouse Leks from Coal Mine Development—Upper and Lower Coal Production Scenarios

Lek Categories	2010/Lower	2010/Upper	2015/Lower	2015/Upper	2020/Lower	2020/Upper
Number of Directly Affected Leks	10	10	15	15	15	15
Number of Leks within Two Miles of Coal Mining Activity	47	47	47	49	50	49

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Seven special status fish species potentially occur in the PRB Coal Review Task 3 study area subwatersheds: the flathead chub (*Platygobio gracilis*) (Antelope Creek, Upper Cheyenne River, and Little Powder River subwatersheds), plains topminnow (*Fundulus sciadicus*) (Upper Cheyenne River), goldeye (*Hiodon alosoides*) (Little Powder River), lake chub (*Couesius plumbeus*) (Little Powder River), mountain sucker (*Catostomus platyrhynchus*) (Little Powder River), silvery minnow (*Hybognathus argyritis*) (Little Powder River), and plains minnow (Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River). Potential impacts on special status fish species from development activities would be similar to effects discussed above for fisheries. Surface disturbance in three subwatersheds (Upper Cheyenne River, Upper Belle Fourche River, Little Powder River) could alter habitat or affect water quality conditions for special status fish species. Erosion control measures, as required by existing and future permits, and NPDES permit requirements would be implemented for each project. These efforts would help decrease disturbance-related sediment input into stream segments that may contain one or more of the special status fish species. Therefore, it is anticipated that impacts on special status fish species would be low.

4.2.10 Land Use and Recreation

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on land use and recreation as a result of projected development activities in the PRB Coal Review Task 3 study area (map 4-2). The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. Table 4-10 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

The PRB is a predominantly rural, wide open landscape. With little rainfall and limited alternative sources of water, the primary land use is grazing. Nevertheless, there is a range of other land uses. The major categories include agriculture, forested, mixed rangeland, urban,

water, wetlands, coal mines, and barren land. The relative amounts of these lands in the PRB Coal Review Task 1 and Task 2 study area (map 4-1) is tabulated in table 4-27.

Table 4-27. PRB Land Use by Surface Ownership

Use Category	Surface Ownership				Total	
	BLM	USDA-Forest Service	State	Private	Acres	Percent
Agriculture	2,627	14,197	13,770	472,811	503,405	6.3
Barren	165	205	187	9,396	9,953	0.1
Forested	137,555	14,604	48,645	332,062	532,866	6.7
Mixed Rangeland	732,014	218,156	561,363	5,271,644	6,783,177	86.0
Urban	893	17	1,039	25,469	27,418	0.3
Water	35	73	334	4,773	5,215	<0.1
Wetlands	0	104	559	1,566	2,229	<0.1
Coal Mines	149	7,236	2,805	40,917	51,107	0.6
Total	**873,438**	**254,592**	**628,702**	**6,158,638**	**7,915,370**	**100.0**

Source: PRB Coal Review Task 1D Report (BLM 2005e)

A large part of the PRB consists of split-estate lands (privately owned surface lands underlain by federally owned minerals). This results in conflicts between surface users, which are mainly ranching interests and mineral developers.

Conflicts with some dispersed rural residences may also occur, although specific locations cannot be identified until development is proposed.

Much of the Task 3 study area is also used for dispersed recreational activities such as hunting. That study area includes surface lands that are federally, state, and privately owned; the entire general analysis area is under private ownership. With nearly 80% of the overall study area privately owned, public lands provide important open space and recreation resources including both developed recreation facilities and areas to pursue dispersed recreation activities. The private sector contributes the elements of commercial recreation opportunities and tourism services such as motels and restaurants. Some private land owners also allow hunting with specific permission, sometimes for a fee.

4.2.10.1 Grazing and Agriculture

Potential impacts on grazing in the Task 3 study area as a result of development activities can be classified as short term and long term. Potential short-term impacts arise from:

- the temporary loss of forage as a result of vegetation removal/disturbance;
- temporary loss of animal unit months (amount of forage a cow/calf unit or a single bull can eat in a month, used to determine stocking rates for livestock);

- temporary loss of water-related range improvements, such as improved springs, water pipelines, and stockponds;
- temporary loss of other range improvements, such as fences and cattle guards; and
- restricted movement of livestock within an allotment due to the development and operation of projects like surface coal mines, which would cease after successful reclamation had been achieved and replacement of water-related and other range improvements had been completed.

The discharge of produced water could increase the availability of water to livestock, which may offset the temporary loss of water-related range improvements. Potential long-term impacts consist of permanent loss of forage and forage productivity in areas, such as power plants, that would not be reclaimed in the near term. Indirect impacts may include dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which decreases the amount of desirable forage available for livestock grazing in the long term.

Development activities could result in short- and long-term impacts on agricultural land, depending on their spatial relationship. Short-term impacts would include the loss of crop production during development and operational phases of the projects. Long-term impacts would result from the permanent loss of agricultural land due the development of permanent facilities such as power plants and railroads.

Table 4-28 contains an estimate of the number of animal unit months unavailable on lands disturbed and not yet reclaimed through 2020 for the high and low levels of predicted development activity, along with the acreage of cropland estimated to be affected.

Table 4-28. Animal Unit Months and Acres of Cropland Estimated Unavailable on Lands Disturbed and Not Yet Reclaimed as a Result of Development Activities

Category	2003/ Baseline	2010/ Lower	2010/ Upper	2015/ Lower	2015/ Upper	2020/ Lower	2020/ Upper
Unavailable AUMs[1]	18,150	22,467	22,792	23,245	23,761	22,514	23,333
Unavailable Crop Land (acres)	48	59	60	134	139	206	289

AUMs = animal unit months

[1] Based on an average stocking rate of 6 acres per AUM.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

4.2.10.2 Urban Use

It is expected that there would be additional expansion of urban residential and commercial development as a result of the projected 48% growth in population (between 2003 and 2020) in Campbell County. Section 4.2.13 and the Task 3C Report of the PRB Coal Review (BLM 2005a) contain additional information on employment and population issues in the study area. A majority of the new urban development would be expected to occur adjacent to existing communities, primarily Gillette, which accounts for approximately 60% of the Campbell County

population and, to a lesser extent, Wright and other small communities. Most of this development would occur on land that is currently used for grazing or agriculture.

4.2.10.3 Recreation

Accessible public lands provide diverse opportunities for recreation, including hunting, fishing, off-road vehicle use, sightseeing, and wildlife observation. The National System of Public Lands generally provides dispersed recreational uses in the study area. Some developed recreational facilities occur in special management areas, including recreation areas. While opportunities are available on public lands throughout the PRB, the majority of dispersed recreational uses occur in the western part of the PRB Coal Review Task 1 and Task 2 study area, including the South Big Horn Mountains area and along the Powder River. Public lands elsewhere consist mainly of isolated tracts of land that are too small to provide a quality recreational experience. Larger parcels of public lands occur in the southwest part of Johnson County and along the Powder River (administered by BLM) and in the Thunder Basin National Grassland (administered by the USDA Forest Service). Public lands are accessible via public roads or across private land with the landowner's permission.

Hunting is a major recreation use of state and federal lands in the study area. Various big game and upland game bird species are hunted in the region. Fishing is a popular year-round activity for residents of the study area.

Mule deer and pronghorn hunting are by far the most popular hunting activities in the Task 1 study area, accounting for 35,529 and 21,304 hunter days, respectively, in 2003 (Stratham pers. comm.). The next highest were cottontail rabbit (2,348 hunter days) and elk (2,055 hunter days), followed by wild turkey (1,019), sharp-tailed grouse (508), and sage-grouse (38). Consistent trends in hunter activity over the past decade are not discernible from the WGFD data considered in the PRB Coal Review. All of the most prominent species hunted in the study area have had high years and low years. Pronghorn hunting, for example, was greatest from 1993 to 1996, while elk hunting was at its peak in 2001 and 2002. Mule deer hunting has been the most consistent, ranging from a low of 28,311 hunter days in 1996 to a high of 37,307 hunter days in 2002.

Off-road vehicle use in the Task 1 study area is available on most BLM-managed lands. Much of the public land in Johnson, Sheridan, and Campbell counties has been inventoried and designated as open, limited, or closed to off-road vehicle use. For the baseline year, approximately 20,386 acres were open to unlimited vehicle travel on and off roads. There were 4,680 acres in the area that were closed to all off-road vehicle use and approximately 867,534 acres were available for limited use. Limited use typically means off-road vehicles are restricted to existing roads and vehicle routes.

Recreational use of public lands in the Task 1 study area has increased substantially over the past two decades, and is expected to continue to increase by about 5% every five years for most recreational activities (BLM 2003). Total visitor use by residents and nonresident visitors in Campbell and Converse counties in 1980 was projected at 1,276,000 visitor days (BLM 1979).

The total visitor days of 1,881,763 estimated for 1990 was approximately 47% higher than the 1980 visitor days (BLM 2001). Fewer than 3% of visitor days were estimated to occur on public lands.

Few, if any, of the developed recreation sites in the PRB Coal Review Task 3 study area would be affected by development-related disturbance. As most of the projected disturbance area would occur on privately owned surface land, the extent of effects on dispersed recreation activities largely would depend on whether the disturbance areas had been open to public or private lease hunting. It is projected that cumulative development activities, especially the dispersed development of CBNG and, to a lesser extent, conventional oil and gas, would tend to exacerbate the trend toward a reduction in private land available for public hunting, which has been observed by WGFD in recent years (Shorma pers. comm.). A reduction in available private land for dispersed recreation would contrast with the anticipated increase in demand for recreational opportunities and would tend to push more recreationists toward public lands where the BLM has projected a 5% increase in use every five years (BLM 2001). After coal- and oil and gas-related development activities have been completed and the disturbed areas have been reclaimed, many of the adverse effects on dispersed recreation activities would be reduced.

It is expected that the development activities also would tend to expand and exacerbate the qualitative degradation of the dispersed recreation experience, in general, and of the hunting experience, in particular, as reported by the WGFD (Jahnke pers. comm.). As noted in the Task 1D Report of the PRB Coal Review (BLM 2005e), reductions in land available for hunting also make herd management more difficult for the WGFD and reduce its hunting-derived revenues (Shorma pers. comm.).

No direct effects on wilderness or roadless areas would be expected from the projected development activities. There are no designated wilderness areas in the study area, and mineral development would not be permitted in the Fortification Creek Wilderness Study Area until and unless Congress acts to remove it from wilderness consideration.

No Wild and Scenic Rivers would be affected because the only river segment identified as both "eligible" and "suitable" in the Task 1D Report of the PRB Coal Review is outside of the PRB Coal Review Task 3 study area.

4.2.11 Cultural Resources and Native American Concerns

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on cultural resources from projected development activities in the PRB Coal Review Task 3 study area. The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. Table 4-10 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

Cultural sites occur throughout the study area. Surface-disturbing activities can result in the loss or destruction of these sites. Table 4-29 contains an estimate of the amount of projected disturbance through 2020 for the projected lower and upper levels of coal development activity, along with the number of cultural sites estimated to be affected. The sites fall into two categories; prehistoric sites and historic sites, as described below. Also below are descriptions of Native American traditional cultural places and a summary of the program to protect sites in any of these categories.

4.2.11.1 Prehistoric Sites

All recognized prehistoric cultural periods, from Clovis through Protohistoric (about 11,500 to 200 years ago), are represented in the PRB Coal Review study area (see section 3.12 for additional discussion about the prehistoric cultural periods.) Only a small number of sites represent the earliest prehistoric cultural periods--Paleoindian through Early Plains Archaic. Archaic and later prehistoric period sites (Archaic to Protohistoric) are represented in increasing numbers because of higher populations through time and better preservation of more recent sites. Important prehistoric site types in the region include artifact scatters, campsites, stone circles, faunal kill and processing sites, rock alignments and cairns, and stone material procurement areas.

Artifact scatters dominate prehistoric sites in the study area. When there is adequate information to evaluate these types of sites, most are not eligible to the NRHP. However, complex sites and sites with buried and dateable material can yield important information and are often field evaluated as eligible. The proportion of unevaluated sites is lower in the subwatersheds in which more studies and more follow-up studies have been conducted, such as Antelope Creek, Upper Cheyenne River, and Upper Belle Fourche River. Some portions of some of the subwatersheds which have more varied habitats or conditions more conducive to preservation are very rich in significant prehistoric sites. Within the PRB Coal Review Task 3 study area, these areas include the lower Antelope Creek drainage and eastern portions of the upper Belle Fourche River. While six prehistoric sites were documented in the general analysis area, it does not appear to be particularly plentiful in significant prehistoric sites. More detailed information on the known cultural sites that are present in the PRB based on the existing surveys is included in the Task 1D Report for the PRB Coal Review (BLM 2005e).

4.2.11.2 Historic Sites

In the PRB region, sites are documented within the broad contexts of rural settlement, urban settlement, mining, transportation, military, exploration, and communication. Each of these site categories and the types of sites they include are detailed in the Task 1D Report for the PRB Coal Review (BLM 2005e). Eight historic sites documented in the general analysis area fall under the context of rural settlement. Evaluation of the importance of historic sites, districts, and landscapes must consider aspects of both theme and period in assessing the historic character and contributing attributes of the resources.

4.2.11.3 Native American Traditional Cultural Places

There are known traditional cultural properties in the region such as the Medicine Wheel in the Big Horn Mountains, Devils Tower, and Pumpkin Buttes. These sites are not only eligible for inclusion in the National Register because of their historic and scientific significance, they are also associated with cultural practices or beliefs of several tribes that are rooted in their histories and are also important in maintaining their continuing cultural identities. Tribes may also attribute a sense of sacredness to more discrete sites such as stone circles, cairns or rock art. Any identification of sacred or traditional localities must be verified in consultation with authorized tribal representatives.

4.2.11.4 Site Protection

At the time an individual project is permitted, the development activities considered in this study would be subject to the following regulations relative to cultural resources. Section 106 of the National Historic Preservation Act of 1966 as amended, its implementing regulations (including but not limited to 36 CFR 800, 36 CFR 61, and Executive Order 11593), and NEPA and its implementing regulations, including 40 CFR 1500 - 1508, provide the legal environment for documentation, evaluation, and protection of historic properties (cultural resources eligible for inclusion on the NRHP) that may be affected by development activities. In cases of split estate, cultural resources are the property of the surface owner, although federal agencies must ensure that federal undertakings adhere to applicable laws and regulations. The surface owner must be consulted about investigation, mitigation, or monitoring.

Table 4-29. Square Miles of Projected Cumulative Disturbance and Number of Potentially Affected Cultural Resource Sites in the PRB Coal Review Task 3 Study Area—Lower and Upper Coal Production Scenarios

		Lower Coal Production Scenario						Upper Coal Production Scenario					
		Year 2010		Year 2015		Year 2020		Year 2010		Year 2015		Year 2020	
Subwatershed	Average Number of Sites per Square Mile[1]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]
Antelope Creek	4.7	74	346	97	484	122	608	75	376	99	496	126	629
Dry Fork Cheyenne River	8.9	8.3	74	12	109	17	151	8.3	74	12	109	17	151
Little Powder River	4.6	90	415	108	495	123	567	91	419	109	502	125	577
Upper Belle Fourche River	4.3	164	704	186	801	209	899	166	713	192	824	219	940
Upper Cheyenne River	5.2	60	314	72	375	83	433	62	321	74	387	85	445
Upper Powder River	5.0	135	674	190	953	232	1,159	135	674	191	953	232	1,159
Total		**531**	**2,527**	**665**	**3,217**	**786**	**3,817**	**537**	**2,577**	**677**	**3,271**	**804**	**3,901**

1 Average number of sites per square mile based on previous surveys in the study area.

2 Calculated based on database disturbance acreages prepared for the Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Development Activities (appendices A and D) (BLM 2005b).

3 The number of sites was calculated by multiplying the average density of known cultural sites per square mile (based on previous surveys) by the number of square miles of projected cumulative disturbance.

Source: Task 3D Report for the PRB Coal Review Cumulative Environmental Effects (BLM 2005f)

4.2.12 Transportation and Utilities

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts on transportation and utilities systems as a result of projected development activities in the PRB Coal Review Task 3 study area. The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. The total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Generally, transportation systems in the study area would not be directly affected by the disturbance associated with projected development. Site-specific instances of disturbance may require that segments of highways, pipelines, transmission lines, or railroads be moved to accommodate expansion of certain coal mines. In such cases, the agencies authorized to regulate such actions would have to approve any proposal to move any segments of any transportation systems. Construction of alternative routing would be required prior to closing existing links so that any disruptive effects on transportation systems would be minimized.

The coal mines in the North Gillette subregion currently ship most of their coal via the east-west BNSF rail line through Gillette. That subregion produced 55 million tons per year in the baseline year (2003), which was just 22% of the estimated 250 million tons per year capacity of the BNSF rail line (BLM 2005f). The coal mines in the South Gillette and Wright subregions produced approximately 308 million tons per year in 2003, which was 88% of the estimated 350 million tons per year capacity of the joint BNSF and UP line serving those areas in the baseline year.

Potential effects of development activities on transportation and utilities may be either short- or long-term in nature, varying with the type of development. A power plant or an urban community development would be considered long-term, and the demand for transmission line capacity would be virtually permanent, lasting for the economic life of the activity. The effects of coal production and the related demand for rail capacity would vary with market changes. In recent years, coal production has been increasing, and the PRB Coal Review projects that the trend would continue, as shown in tables 4-2 and 4-3. Similarly, the demand for pipeline capacity would vary with market conditions as well as with the rate of depletion of the oil or gas resource.

Potential direct effects of projected development on roads and highways would include increased vehicular traffic and risk of traffic accidents on existing roadways in the PRB Coal Review Task 3 study area from daily travel by workers and their families. Indirect effects would include increased wear and tear on existing roads, additional air emissions from vehicles, additional fugitive dust from roads, noise, increased potential access to remote areas, and an increased risk of vehicle collisions with livestock and wildlife. Direct effects on railroads, pipelines, and transmission lines primarily would include increased demand for capacity to move coal, oil and gas, and electricity from production locations in the study area to markets outside the area. As

described in section 3.15, Kiewit does not anticipate increasing the current average annual coal production rate or hiring additional employees, so no increases in road or rail traffic are anticipated under either action alternative. Indirect effects would include potential impacts of the accumulation of coal dust and fines blowing or sifting from moving, loaded rail cars. The PRB Coal Review Task 3D Report does not discuss the cumulative effects of coal dust resulting from the transport of coal along rail lines.

The socioeconomic analysis conducted as a part of Task 3C of the PRB Coal Review projects a population increase of approximately 48% between 2003 and 2020 in Campbell County under the upper coal production scenario (BLM 2005a). Campbell County accounts for most of the population in the PRB Coal Review Task 3 study area. Based on traffic studies conducted independently of the PRB Coal Review, vehicle miles traveled tend to increase at or above the rate of population growth. Consequently, highway traffic would be expected to increase by at least 48% by 2020. Approximately 60% of the population growth would occur in or near Gillette, which would indicate that the same proportion of traffic would originate in the Gillette area. The remainder of the traffic growth would be dispersed throughout the study area. Under this scenario, the greatest impact on traffic would occur in the Gillette area, where existing traffic volume to capacity ratios are highest. The increased traffic would be expected to cause delays in the Gillette area and might require widening of some streets and roads or other measures to increase traffic capacity. It is anticipated that there would be an increase in the risk of traffic accidents approximately proportional to the increase in traffic. Highway capacity on major routes away from Gillette would be expected to be sufficient to accommodate the growth without substantial constraints.

Existing rail lines, together with proposed upgrades on the joint BNSF and UP line, would be expected to accommodate the projected coal transportation traffic through 2015 (table 4-30). The PRB Coal Review Task 2 Report (BLM 2005b) projects that the proposed DM&E line would be built and operational by 2015 (pending completion of additional environmental analysis), which would add 100 million tons per year in additional shipping capacity for the South Gillette and Wright subregions. A collaborative effort between the National Coal Transportation Association, the mines, and the BNSF and UP Railroads is resulting in measures to reduce coal dust emissions from loaded, moving rail cars.

Table 4-30. PRB Rail Lines Coal Hauling Capacity and Projected Use

	2010 Projected			2015 Projected			2020 Projected		
	2010 Capacity	Rail Use Increase[1]		2015 Capacity	Rail Use Increase[1]		2020 Capacity	Rail Use Increase[1]	
Rail Line	mmtpy	mmtpy	%	mmtpy	mmtpy	%	mmtpy	mmtpy	%
North BNSF	250	62–78	25–31	250	74–104	30-42	250	78–121	31–48
South BNSF and UP	400	349–401	87–100	500	393–439[2]	79–88[2]	500	417–455[2]	83–91[2]
DM&E	0	0	0	–2	–3	–3	–2	–3	–3

mmtpy = million tons per year; BNSF = Burlington Northern Santa Fe;, UP = Union Pacific; DM&E = Dakota, Minnesota & Eastern

[1] The range of increase in use shown for each year reflects the increases that are projected for the lower and upper coal production scenarios, respectively.

[2] The DM&E is assumed to be built and operational by 2015, adding 100 mmtpy of capacity for the mines served by the BNSF & UP south line.

[3] The BNSF & UP south figures represent the projected combined traffic and percent capacity on the BNSF & UP south line and the projected DM&E line.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

The Task 2 Report for the PRB Coal Review projected that basin-wide production of CBNG could double by 2020, which would suggest that additional pipelines could be built. One potential additional pipeline (Bison Project) was identified for completion by November 2010. The filing for this project was made with the Federal Energy Regulatory Commission on June 2, 2008. Other potential projects are discussed in section 4.1.2.3.1.

An estimated 1,700 MW of new power production capacity is anticipated in the cumulative effects area by 2020. This level of production would require construction of additional transmission lines. It is assumed that new transmission lines would be constructed to connect new power plants to the grid.

4.2.13 Socioeconomics

The cumulative socioeconomic impact analysis focuses on Campbell County, but also considers Converse, Crook, Johnson, Sheridan, and Weston counties as directly affected and Niobrara and Natrona counties as indirectly affected. Recent and projected socioeconomic conditions are described in more detail in the Task 1C and 3C reports for the PRB Coal Review (BLM 2005c and 2005b).

REMI Policy Insight REMI, a professionally recognized regional economic model, was used to develop the cumulative employment and population projections presented below. The version of the REMI model for the PRB Coal Review was comprised of two economic regions: one being Campbell County alone, the second composed of those Wyoming counties bordering Campbell County and linked to its economy by established industrial and consumer trade and by work force commuting patterns. Results for the second region were analyzed to focus on the five counties (Converse, Crook, Johnson, Sheridan, and Weston) that are the most directly linked. Collectively, these five counties are referred to in the PRB Coal Review Task 3C Report (BLM 2005a) as the surrounding counties. Additional analysis was undertaken to translate the population and employment forecasts for each of the surrounding counties into housing needs and to project future school enrollment.

During the 1970s and early 1980s, the PRB emerged as a major coal producing region. Federal coal leasing has been a high profile activity because over 90% of the coal resources in the PRB are federally owned. The surface coal mines that developed during that time are now mature operations that provide a stable economic and social foundation for the region. While energy development has produced periodic surges in population, followed occasionally by population declines in some communities, the growth in domestic energy consumption, coupled with the PRB's vast energy resource base, has resulted in a 50-year growth trend in the region without the severe economic dislocations that have characterized other western U.S. resource booms.

This period of extended energy development has been accompanied by substantial economic changes and benefits, including economic growth, employment opportunity, tax revenue growth, and infrastructure development for local governments, both locally and across Wyoming, funded by tax revenues generated by coal production and other energy resources. At the same time, periods of rapid growth have stressed communities and their social structures, housing resources, and public infrastructure and service systems.

The emergence of the coal and other energy resource development industries in the PRB has had long-term cumulative effects on regional social and economic conditions. In general, Campbell County and the entire PRB region have developed an enhanced capacity to respond to and accommodate growth. The regional coal industry also provides a measure of insulation from dramatic economic and social dislocations. Key cumulative social and economic conditions identified in the PRB Coal Review are described below.

4.2.13.1 Employment and the Economic Base

Energy resource development since 1970 has resulted in substantial economic expansion across the PRB. Total employment expanded by 163% as 40,674 net new jobs were added between 1970 and 2004. The most rapid expansion occurred between 1975 and 1980. After modest growth and a slight decline in the 1980s and early 1990s, employment growth resumed in the late 1990s, led by increases in coal mine employment, including subcontractors, and CBNG development. Across the six-county area, total employment was 65,597 in 2004. Nearly half of the net job gain occurred in Campbell County, where total employment increased from 6,026 jobs in 1970 to 25,921 jobs in 2004. Strong gains also were posted in Sheridan County (9,821 jobs) and Converse County (4,421 jobs).

The economic stimuli associated with the gains in mining and CBNG employment and the long-term population growth triggered secondary job gains in construction, trade, services, and government. In 2004, business and consumer services accounted for 51% of all jobs in the region, while mining and government accounted for 14% and 16% of all jobs, respectively. Farm employment in the region, as a share of total employment, declined from 14% in 1970 to 5.0% in 2004. However, that shift is primarily due to growth in non-farm employment rather than declines in farming, as total farm employment in the PRB recorded a net decline of only 375 jobs, from 3,571 to 3,196 (U.S. Bureau of Economic Analysis 2006).

The largest impetus to future growth over the PRB Coal Review study period (2003 to 2020) is expected to occur by 2010. Under the lower production scenario, employment in 2010 related to coal mining, oil and gas production, and oil field services is projected to increase by one-third, or more than 2,300 jobs, as compared to 2003 levels. Many of the jobs gained would be the result of increased oil and gas development. While the number of coal mining jobs would increase, the projected coal mine-related productivity gains would limit increases in the number of mine employees required for operations.

Beyond 2010, total mining industry employment would decline as major infrastructure development (e.g., additional CBNG compression capacity) is completed and the pace of conventional oil and gas drilling decreases. Increases in CBNG production and coal mining employment would occur thereafter, such that total mining employment would approach pre-2010 levels by the end of the forecast period (2020). Under the development scenarios, construction of three new power plants, having a combined capacity of 1,000 MW and a peak work force of approximately 1,550 in 2007–2008, is assumed to occur concurrently with the increases in mining employment. Under the upper production scenario, a second temporary construction work force impact would occur between 2016 and 2020 in conjunction with the construction of an additional 700-MW power plant.

The net effects of these activities, including secondary effects on suppliers, merchants, service firms, state agencies and local government in the region, would be the creation of more than 8,700 new jobs between 2003 and 2010. Of those, more than 5,600 jobs (a 22% increase over 2003) would be based in Campbell County. The pace of economic expansion, at least in terms of jobs, would moderate after 2010. Total employment growth of 2,017 additional jobs is projected in Campbell County between 2010 and 2020, with 1,741 additional jobs projected in the surrounding counties.

However, to achieve the projected levels of energy and mineral development activity through 2010 assumes that industry has access to the necessary equipment, materials, labor, and other vital inputs. Current oil and gas exploration and development across the Rocky Mountain region has absorbed the available inventory of drilling rigs and crews. A lack of access to resources could delay or limit the job gains below the levels projected, even though prospects for such growth remain. Furthermore, competition for equipment, combined with tight labor markets, could negate the productivity gains that underlie the projections, such that the employment and associated impacts do materialize, but are associated with lower levels of activity (e.g., a lengthier construction period for a power plant or fewer new wells drilled each year).

Employment effects associated with the upper coal production scenario, assuming productivity gains in coal mining equivalent to those in the lower coal production scenario, would result in total employment gains of 11,563 jobs by 2010 in the six-county study area, with an additional 3,667 jobs by 2020[1]. As compared to the employment projections under the lower coal

1 The number of jobs in the coal mining industry under the upper production scenario was estimated assuming future productivity gains comparable to those used for the lower production scenario. This approach differs from that described for the upper production scenario in the Task 2 report of the coal study, whereby a 16% higher production would be achieved with a 2.5% increase in workforce. Although that assumption reflects a continuation of historic productivity gains, it may underestimate population and employment growth and related

production scenario, those gains include 2,821 additional jobs in 2010 and 3,214 additional jobs in 2020. Most of the incremental gains would be in Campbell County, further stressing labor markets, housing, and other community resources. Such pressures could delay or affect the development plans of individual firms and operators, such that the projected employment levels would not be realized in the time frames shown. Nonetheless, substantial growth in employment is expected to occur, and even if the projected total employment levels are not realized, substantial social and economic impacts still would be anticipated.

The economic stimuli associated with the projected development also would stimulate increases in employment in other nearby counties beyond the five surrounding counties identified above. However, the potential effects in these areas are not addressed in the PRB Coal Review Task 3C Report because most of the effects would comprise indirect or induced growth that would be limited in scale relative to the size of the respective economies. Furthermore, the economic outlook for those areas is influenced by factors that are beyond the scope of this study, such as the role of the oil and gas support services industry based in Natrona County in supporting energy development in the south-central and southwestern portions of Wyoming.

4.2.13.2 Labor Market Conditions

Labor market conditions in the PRB reflect a generally healthy economy, with average annual county unemployment rates between 2.1% (Campbell) and 3.5% (Weston) in 2006. Statewide and national unemployment rates for the period were 3.2% and 4.6%, respectively (U.S. Bureau of Labor Statistics 2007).

Over time, local unemployment levels and rates have reflected the influences of the large, relatively stable employment baseline associated with the region's coal mining industry and the more transitory and variable influences of natural gas development. Prior to the onset of CBNG development in 1989, unemployment in Campbell County fluctuated between 4.8 and 5.3%, slightly above the corresponding statewide averages. Labor demand associated with CBNG development contributed to a decline in unemployment to below 3.0% in the 2001. As the pace of CBNG development stabilized, labor demand eased and unemployment rates climbed to 3.7% in 2003, before again falling to current record lows.

The employment effects identified above indicate substantial pressures on local labor markets. Strong demand for labor would maintain low unemployment, creating upward pressure on wages and salaries. Those influences would stimulate substantial economic migration into Campbell County, causing impacts on population, housing demand, and other economic and social conditions. Similar influences would occur in surrounding counties, although the implications are less severe because the scale of effects would be smaller and would be distributed over multiple communities and service providers.

socioeconomic effects if the production levels are achieved but productivity lags. Using the productivity gains from the lower production scenario provides a more conservative perspective on potential long-term population growth for purposes of the cumulative analysis.

4.2.13.3 Personal Income

A benefit associated with energy resource development, whether it is mineral mining or oil and gas development, is local wages and salaries that are among the highest in the state. Personal income registered strong gains across the region, but especially in Campbell County, during the late 1970s and early 1980s. In 1981, per capita personal income in Campbell County was $17,520, compared to the national average of $11,280 and the statewide average of $12,879. Personal income growth was tempered by several years of economic stagnation during the late 1980s. Renewed economic vitality since then resulted in per capita personal income in Campbell County reaching $33,388 in 2004. Those gains notwithstanding, per capita income among Campbell County's residents was below statewide and national norms, as well as that for Sheridan ($35,716) County. When measured on a median household or family income basis in the 2000 census, Campbell County led statewide, national, and other counties in the PRB by considerable margins. That pattern has been maintained due to the strong economic growth in the region; in 2006, the median household income in Campbell County was $60,800 compared to a statewide median of $43,785 and national median of $44,374. Median household incomes for the other five PRB counties ranged from $40,195 to $46,883 (U.S. Census Bureau 2006a).

In terms of total personal income, Campbell County led the six-county region with $1.22 billion in 2004. Sheridan County residents recorded aggregate personal income of $972 million in 2004. Total personal income in the other counties was substantially lower, ranging from $193 million in Crook County to $389 million in Converse County.

Personal incomes in the region would increase over the period 2007–2020, both in aggregate and on a per capita basis, in conjunction with the economic outlooks foreshadowed by the projected development scenarios. In 2004, total personal income in the six-county area was $3.24 billion. Under the lower production scenario, total personal income would more than double to $7.57 billion in 2020 (in nominal dollars). The upper production scenario would generate an additional $266 million per year in Campbell County and an additional $35 to $40 million per year in the surrounding counties by 2020. Annual per capita incomes are projected to increase by approximately 27% (in real terms) across the region between 2003 and 2020. Households with one or more workers employed directly in the energy industry, associated service firms, and the construction industry likely would realize larger shares of the gains (BLM 2005a).

4.2.13.4 Population and Demographics

Population change over time is perhaps the single best indicator of cumulative social and economic change in the PRB. Campbell County was not among the original 13 counties when Wyoming was admitted to statehood, but was carved from Weston and Crook Counties in 1911. Campbell County's 1920 population of 5,233 ranked it seventeenth among Wyoming's counties. Forty years later and prior to the onset of coal development in the region, Campbell County ranked eighteenth among Wyoming's counties in terms of population, with a 5,861 residents. Neighboring Converse, Sheridan, and Weston counties had larger populations.

By 1980, Campbell County's population had increased by more than 300%, to 24,367, seventh among Wyoming's counties. Energy development contributed to population growth in Sheridan, Converse, Johnson, and Crook counties during that period. Weston County recorded a population decline during the period; however, the combined population of the PRB climbed from 49,311 in 1960 to 82,598 in 1980.

Annual coal production in the PRB has increased by nearly 560% since 1980, accompanied by expanded mine service and rail transportation capacity, stimulating further growth. The impetus for growth in local employment was tempered by substantial productivity increases in the mining industry, coupled with declining production of other energy resources. Consequently, the region's population gained a relatively modest 11%, 9,318 residents, between 1980 and 2000, reaching 91,916. Campbell County registered a net gain of 9,331 residents during that period, raising its total population to 33,698 in 2000, fourth highest in the state. Across the PRB, the loss of about 2,000 residents in Converse County was offset by modest gains in the other four counties (U.S. Census Bureau 2001).

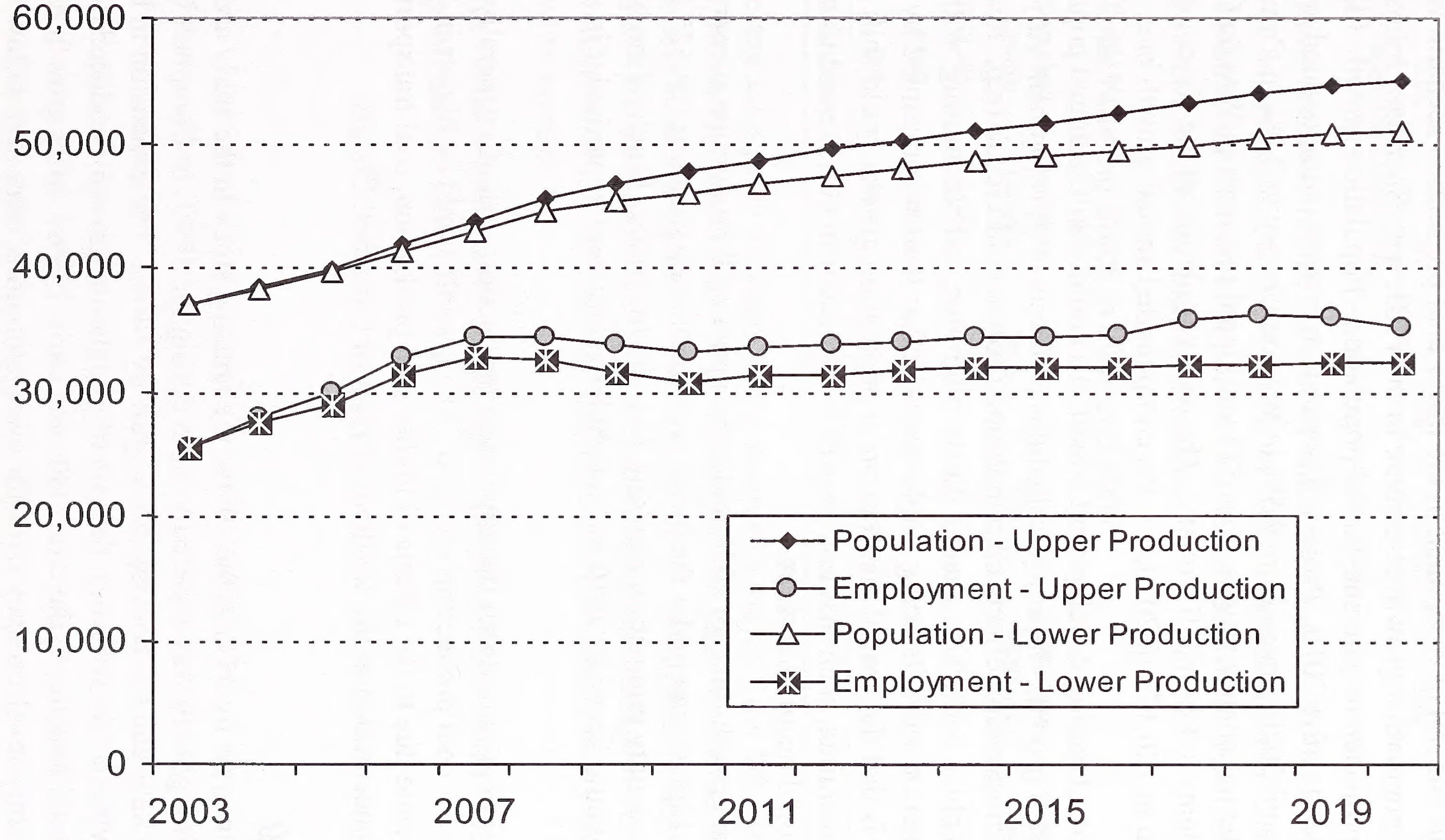
More recently, the PRB has seen renewed population growth, primarily linked to CBNG development. Population estimates for 2006 indicate a total regional population of 100,504, a 9.3% increase over the 2000 census population. Gains were reported for all six counties, ranging from 118 persons in Weston County to 5,236 persons in Campbell County (table 4-31).

Table 4-31. Recent and Projected PRB Population

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six County PRB Total
CENSUS							
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,438	12,314	5,986	7,554	27,115	6,671	95,078
2007	40,433	12,868	6,284	8,142	27,998	6,854	102,579
LOWER COAL PRODUCTION SCENARIO							
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
UPPER COAL PRODUCTION SCENARIO							
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

Source: U.S. Census Bureau (2007-historical data) and PRB Coal Review Task 3C Report (BLM 2005a)

The magnitude and timing of projected employment changes from 2003-2020 under either coal production scenario would trigger corresponding effects to population across the PRB, particularly in Campbell County (figure 4-3).



Source: PRB Coal Review Task 3C Report (BLM 2005f)

No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 4-3
Projected Campbell County Population and Employment to 2020

Under the lower coal production scenario, Campbell County's population is projected to increase by more than 14,550 residents between 2003 and 2020, nearly 9,500 of which are anticipated by 2010; Kiewit does not anticipate any new hiring under either action alternative. Growth over the next three years will maintain pressures on housing and other community resources. The projected energy and mineral development in the lower coal production scenario would also result in substantial population growth elsewhere in the PRB, with Sheridan, Johnson, and Converse counties projected to gain substantial population. Population growth, like employment growth, would moderate after 2010. Projected population growth (compounded annual growth rate) between 2003 and 2020 ranges from 0.5% in Weston County to 2.0% in Campbell County. In absolute terms, the net change ranges from 537 additional residents in Weston County to a gain of 14,557 residents in Campbell County. The total population of the six-county study area is projected to climb to 120,178 in 2020, a 1.3% compounded annual growth rate.

As with employment, changing development conditions could result in actual population growth varying from projected growth. If project schedules or levels of development vary from the projected levels, corresponding effects on population growth could result (e.g., lower growth). Population demographics could also change due to migration and commuting, with more immigrating construction workers being single-status, rather than accompanied by families. Another possibility is that the spatial distribution of population growth could shift as a result of housing or labor constraints, such that less growth would occur in Gillette and Campbell County, and more growth would occur elsewhere.

Projected population growth through 2020 under the upper coal production scenario is approximately 19% higher than under the lower coal production scenario (28,625 compared to 24,100, with the six-county population reaching 124,703 by 2020). Much of the incremental population growth would occur by 2010 in Campbell County, and in particular in and near Gillette.

Community population growth under the upper coal production scenario generally would mirror growth under the lower coal production scenario. The growth would be higher in Wright, Douglas, and Newcastle due to the effects of higher coal production, coal transportation, and power generation concentrated in the southern portion of Campbell County.

4.2.13.5 Housing

While the population grew by 55% in the 1970s, the housing stock in the study area grew by almost 78%. Housing growth was especially rapid during the 1970s in Campbell County, where population grew by 88% and the housing stock grew by 140%. The expansion in housing supply, combined with the slowdown in the rate of population growth, produced double-digit vacancy rates for rental housing in the late 1980s and early 1990s. After growth resumed in the mid-1990s, most county-level vacancy rates for ownership units were at or below the state levels in 2000. Vacancy rates for rental units declined even more sharply. Vacancy rates have fallen even more as a result of recent growth, with current rates below 1.5% in five of the six-counties, and that in Johnson County at only 2.8% (Table 4-32).

Table 4-32. Rental Housing Vacancy Rates

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Wyoming
2004 (4th quarter)	2.8%	8.3%	10.4%	2.1%	4.5%	5.0%	4.8%
2006 (4th quarter)	0.4%	1.4%	1.0%	2.8%	0.5%	0.0%	2.4%

Source: Wyoming Housing Database Partnership (2007)

In 2000, the housing inventory in the six-county study area was 41,203 units (table 4-33). Total housing inventory had expanded to 43,363 units in 2005, a net addition of 2,160 since 2000. However, new construction has not kept pace with population growth, resulting in tighter market conditions in terms of availability, and higher prices.

Table 4-33. Total Housing Stock in 2000 and 2005

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six-county PRB Region
2000	13,288	5,669	2,935	3,503	12,577	3,231	41,203
2005	14,085	5,852	3,132	3,694	13,283	3,317	43,363
Change	797	183	197	191	706	86	2,160

Source: U.S. Census Bureau (2006b)

In 2005, the average sales price of homes in the study area varied from $80,303 in Weston County to $186,095 in Sheridan County. The average home price statewide in 2006 was $178,183 (Wyoming Housing Database Partnership 2007). In addition to Sheridan County, Campbell ($185,874) and Johnson ($180,209) counties also had average home sale prices above the statewide average in 2006. The average sales price in Converse County was $149,096, 17% below the statewide average.

Monthly costs for rental housing in the PRB, measured in the fourth quarter of 2006, were highest in Campbell County (table 4-34).

Table 4-34. Monthly Housing Rents in 2006[1] in the PRB Study Area and Percent Change from 2004

	Apartments		Mobile Home Lots		Houses		Mobile Homes on a Lot	
County	Rent	Change	Rent	Change	Rent	Change	Rent	Change
Campbell	$697	25.8%	$283	22.0%	$975	23.0%	$758	20.5%
Converse	$515	31.4%	$152	1.3%	$545	2.8%	$452	22.5%
Crook	$391	17.4%	$125	5.9%	NA	NA	NA	NA
Johnson	$477	-5.4%	$170	16.4%	$700	15.3%	$518	5.5%
Sheridan	$571	14.0%	$285	4.4%	$857	27.9%	$650	26.7%
Weston	$459	47.1%	$119	17.8%	$567	36.3%	$505	27.5%
Wyoming	$567	14.1%	$225	15.4%	$782	13.0%	$561	15.2%

NA = information not available due to insufficient sample size

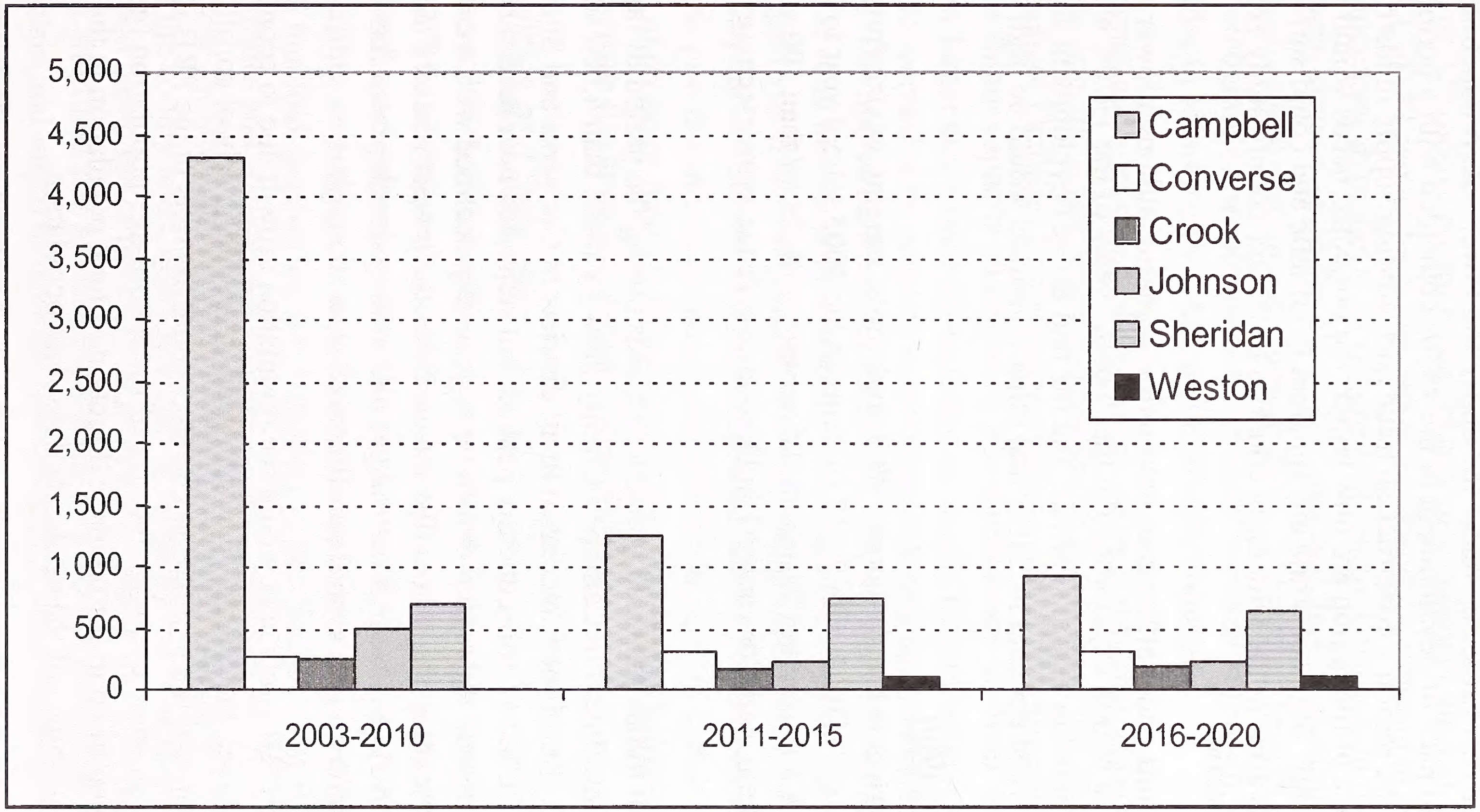
[1] Data are for the fourth quarter of 2006. Change is the percent change since fourth quarter of 2004.

Source: Wyoming Department of Administration and Information (2006)

Temporary housing resources are available in the PRB in the form of hotel-motel rooms, private and public campgrounds, and vacant spaces in mobile home parks. In all, there are more than 70 lodging establishments with a total of more than 2,500 rooms. The temporary housing available, along with apartments, townhouses, and mobile home spaces in Gillette, Wright and Douglas, have accommodated temporary housing needs associated with natural resource and energy projects in the past.

Both projected coal production scenarios indicate a strong demand for housing across the six-county study area through 2020. Net housing requirements under the lower coal production scenario are for approximately 9,110 units through 2020, a 21% increase above the 2006 existing inventory (figure 4-4). New housing requirements under the upper coal production scenario are estimated at 10,900 units, a 25% increase compared to the 2006 inventory and 1,790 units more than for the lower coal production scenario. Approximately 60% of the overall demand for new housing through 2010 would be in Campbell County.

A substantial portion of the near-term housing demand in Campbell County would be associated with the assumed concurrent construction of three power plants. If that occurs, one or more project sponsors may be required by the Wyoming Industrial Siting Administration to pro-actively provide housing (e.g., a construction camp for single-status workers). Such actions could temper the needs for more housing; however, the remaining needs would be substantial, straining public and private sector residential development capacity. Although smaller in scale than those in Campbell County, housing demands in the surrounding counties may also strain the capabilities of the residential construction sector to respond. Furthermore, residential contractors would be competing for available labor, contributing to the population growth and housing demand, and fueling increases in construction costs and housing prices.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure 4-4
Projected Housing Demand in the PRB Study Area under the Lower Coal Production Scenario

The relative scale of the housing needs can be evaluated in comparison to past growth in the study area. One benchmark for comparison is the rapid growth that occurred in the PRB in the 1970s. During that decade, the number of housing units in the six-county study area rose by approximately 14,900 units, approximately 1,500 units per year on average compared to the 850 to 975 new units per year projected under the upper and lower coal production scenarios through 2010. The rapid pace of development in the 1970s coincided with a period of economic expansion and strained the region's construction trade and building supply industries. Although the underlying economies of the region are now larger, the projected needs would tax the ability of communities to respond. Signs of strain are apparent in Gillette and could surface elsewhere as greater housing needs arise in the remaining counties of the six-county study area under the low coal production scenario.

Projected housing demands under either coal production scenario, although lower than what Campbell County and the region experienced in the "boom" years of the 1970s, would exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other resources would be high overall.

4.2.13.6 Public Education

There are 10 school districts in the six-county PRB study area, ranging in size from Campbell County School District (CCSD) #1 with 7,337 students in the 2005 school year to Sheridan County School District # 3 (based in Clearmont, Wyoming) with fewer than 100 students. CCSD #1, based in Gillette, and Converse #1 in Douglas, serve the primary energy and resource development region.

Public school enrollment trends mirrored population trends during the period of rapid population growth. District-wide enrollment in Campbell County grew by more than 4,600 students (131%) between 1975 and 1985. Enrollment increased in all districts in Converse and Sheridan counties as well. Enrollment in CCSD #1 subsequently peaked, but remained near record high levels for nearly a decade. Elsewhere in the region enrollments generally declined with a combined enrollment of 9,525 in the other study area districts in 2005, the lowest since 1975 (Wyoming Department of Education 2006). Recent natural gas and mining development has tempered, but not reversed, the trend of declining school enrollments across the region.

Communities across the PRB study area would see population growth due to economic migration from 2003 to 2020; however, the effects of such migration on public school enrollments would vary. As the demographics of the population change, school districts in the PRB would be affected by new trends. In some counties, the size of the school-age population (generally aged five to 17 years) may even trend in the opposite direction of total population in the short-term due to underlying demographics of the established resident population.

The demographic projections for the two coal production scenarios forecast growth in elementary school enrollments in Campbell County through 2010 and after 2010 for most PRB school districts. Projected enrollments in CCSD #1 would be approximately 10% higher by 2020 under the upper coal production scenario, with those in the surrounding districts about 1%

higher. However, several districts still may experience enrollment levels in 2020 below current levels, as growth from 2010 to 2020 would not offset recent declines or those projected to occur before 2010.

Under the lower coal production scenario, Campbell County would experience an increase of 1,587 students, or 22% above recent levels, in school enrollment through 2020. However, the net impact on CCSD #1 would be composed of two trends; a substantial increase in grades K-8 but only small increases in grades 9-12 (figure 4-5). School districts in the surrounding counties are projected to experience declining elementary and middle school enrollments through 2010 and declining high school enrollments through 2015. Thereafter, growth and the associated influences on demographics would generate renewed enrollment growth, particularly in the elementary grades in Johnson, Sheridan, and Converse counties.

Under either scenario, projected enrollments may cause short-term school capacity shortages, depending on the specific grade levels and residential locations of the additional students. Under the Wyoming School Facilities Commission planning guidelines, impacted school districts need to accommodate minor capacity shortages by using temporary facilities such as portable classrooms. For larger and more long-term increases, the Commission's policy is to fund capital expansion where warranted by projections developed during updates of school districts' five-year plans. The approved five-year plan for CCSD #1 has a $57.4 million budget covering construction of several new schools and numerous major maintenance and facility upgrade projects. The approved five-year plans for the other school districts have combined cost of $163 million. Capital investment in public education facilities has been a statewide priority in Wyoming for the past decade, with taxes and royalties on mineral and energy resources the primary source of program funding (Wyoming School Facilities Commission 2007 and Wyoming Consensus Revenue Estimating Group 2007).

4.2.13.7 Facilities and Services

The types and levels of facilities and services provided by local governments reflect service demand, revenue availability, and community values regarding appropriate services and service standards. As with most socioeconomic characteristics, the level and availability of local government facilities and services varies by county and community across the PRB. There are literally several hundred separate service providers in the region. Although virtually all local government facilities and services are affected by energy development and the demand related thereto, the critical facilities and services include municipal water and sewer systems, law enforcement at the county level, and hospitals. A comprehensive assessment of facilities and services is beyond the scope of the PRB Coal Review. However, an initial screening revealed no critical needs or shortfalls and indicated that most providers are engaged in an ongoing long-term process to maintain and improve facilities and services to meet community needs and to comply with various regulations and standards.

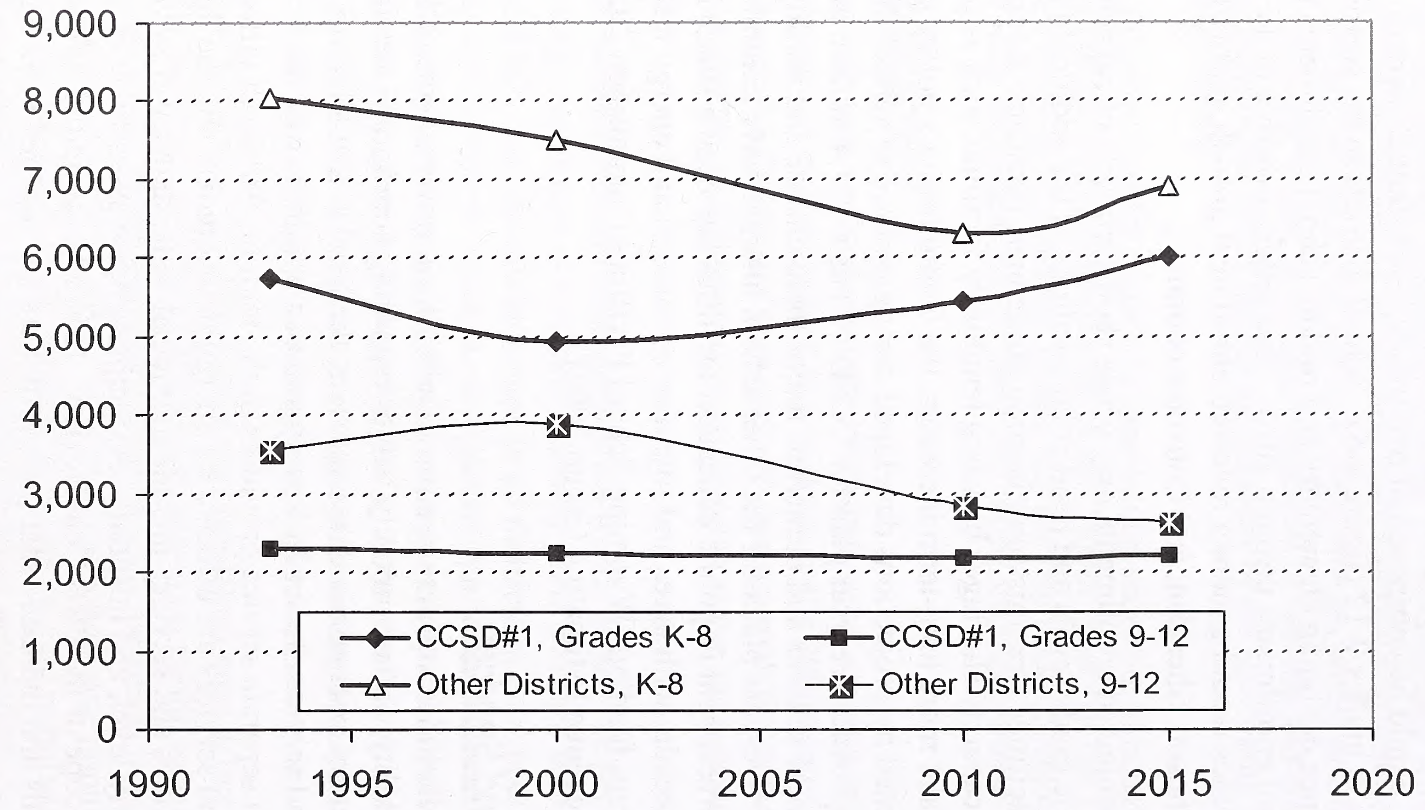


Figure 4-5

Projected School Enrollment to 2020 under the Lower Coal Production Scenario

The PRB Coal Review socioeconomic analysis focuses on water supply and wastewater systems (two essential services that are costly and have the longest lead times to develop) and law enforcement, emergency response, and road maintenance (three services that typically are most affected by energy development).

Water supply and wastewater systems in most communities have the capacity to accommodate the cumulative population growth associated with either projected coal production scenario through 2020, assuming ongoing or planned improvements are completed. In Gillette, there may be a timing issue with planned water supply system expansions, as completion of planned improvements would occur when substantial growth is anticipated under both projected coal production scenarios. Consequently, Gillette may experience water shortages in the summer months for several years, particularly if growth follows that under the upper coal production scenario. Douglas is looking to add water treatment capacity to provide additional capacity and management flexibility to address needs during times of drought.

The ability to provide desired levels of services to the projected energy-related population and development is less clear in Campbell County, Gillette, Wright, and outlying rural communities. Campbell County and its communities would experience a 25% increase in population between 2003 and 2010 under the lower coal production scenario and 30% under the upper coal production scenario.

Growth rates and the resultant facility and service demand in other counties within the study area would be substantially less during the 2003 to 2010 period under either scenario; all communities other than Johnson County and Buffalo would grow substantially less than 10% during the period. The populations of Johnson County and Buffalo would increase 10% by 2010, driven primarily by CBNG development.

Growth rates and resultant increases in service demands would slow substantially during both the 2011 to 2015 and 2016 to 2020 periods under either projected coal production scenario. In most communities except Sheridan County and the city of Sheridan, there would be little difference in population growth and service demand between the two scenarios.

4.2.13.8 Fiscal Conditions

Federal mineral royalties and state and local taxes levied on coal and other mineral production are vitally important sources of public revenue in Wyoming. Taxes, fees, and charges levied on real estate improvements, retail trade, and other economic activity supported by energy development provide additional revenues to support public facilities and services. These revenues benefit not only those jurisdictions within which the production or activity occurs, but also the federal treasury, state coffers, school districts, and local governments across the state through revenue-sharing and intergovernmental transfer mechanisms.

Coal and other minerals produced in Wyoming, regardless of ownership, are subject to ad valorem taxation by local taxing entities and a statewide levy to support public education.

Statewide ad valorem taxable valuation on coal production in 2005 was $2,280.1 million. Of that total, 88% was based on production in the PRB.

The total assessed valuation of Campbell County, boosted by recent increases in CBNG production, was $4,264 million in 2006. Valuations on aggregate mineral production accounted for 87% of that total. Because Campbell County has been the primary beneficiary of mineral production gains over the past three decades and the recent gains tied to CBNG, the county's assessed valuation in 2006 was nearly 38 times that of Weston County ($112.5 million) and 31 times that of Crook County ($137.2 million). The 2006 valuation of 2005 coal production in Campbell County was $1,995.3 million (Wyoming Department of Revenue 2006).

Wyoming levies a severance tax on coal and many other minerals produced in the state. The severance tax rate, levied on the value of production, has varied from 1.0% to 10.5% over time. The current rate of 7.0% was established in 1992. Cumulative statewide severance tax proceeds on coal production since 1970 exceed $2.8 billion. Cumulative severance tax revenues on coal produced in Campbell County total $1.89 billion. Cumulative severance tax revenues for the corresponding period total $96.5 million from Converse County, $60.5 million from Sheridan County, and $758.0 million from the remainder of the state (Wyoming Consensus Revenue Estimating Group 2007; Wyoming Department of Revenue 2006).

Producers pay a 12.5% royalty to the federal treasury on the value of all surface coal production from federal leases. Total federal mineral royalties of nearly $3.3 billion have been paid on coal produced in Wyoming since 1970, approximately half of which is returned to the state. Estimated 2005 mineral royalties of about $377 million were paid on federal coal produced in the PRB (Minerals Management Service 2006).

At the foundation of the mineral development revenue projections for the period 2003 to 2020 are projected levels of future energy and mineral resource production. The projected total value of annual mineral production under the lower coal production scenario would climb by $3.49 billion (2004 dollars) over 2003 levels, reaching $8.54 billion by 2020, a 69% increase over the 2003 value. The aggregate value of energy and mineral resource production under the upper coal production scenario would increase to $9.21 billion in 2020. The incremental difference, compared to the value under the lower coal production scenario, would be $670 million per year, all of which represents the value of higher annual coal output.

The overwhelming majority of future mineral production value is anticipated to be in Campbell County. Over time, the future value of production in Sheridan and Johnson counties would climb. Total annual mineral production value by 2020 is projected to reach $6.37 billion in Campbell County and $2.17 billion in the surrounding counties. Between 2005 and 2020, total royalty and tax receipts derived from the key selected sources range between $21.1 and $22.6 billion for the lower and upper coal production scenarios, respectively. Receipts derived from coal production would account for the majority of the totals under either scenario, with federal mineral royalties on coal at $4.9 to $5.7 billion being the single largest source. Severance taxes, ranging from $6.3 to $6.7 billion, also would accrue to the state (tables 4-35 and 4-36).

The federal and state governments also benefit from coal lease bonus bids derived from future coal leasing. Bonus bids have risen over time, with successful bids for recent sales ranging from 30 cents per ton to 97 cents per ton. There is no guarantee of that trend continuing. Considerable uncertainty also exists with respect to the timing and scale of future leases, although BLM currently has pending applications for more than four billion tons of federal coal, including this application. The state receives 50% of the bonus bid revenue.

Table 4-35. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production under the Lower Coal Production Scenario (million $)

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total
Coal[1]	$3,164.8	$3,178.9	$3,756.3	$10,100.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$6,648.5**	**$6,831.7**	**$7,659.0**	**$21,139.3**
Severance Tax	$1,995.9	$2,012.4	$2,249.3	$6,257.6
Federal Mineral Royalties	$2,754.1	$2,839.4	$3,166.3	$8,759.8
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$417.6	$443.0	$502.8	$1,363.3
Ad Valorem Tax (Schools)	$1,247.5	$1,311.1	$1,489.3	$4,047.9
Totals	**$6,648.6**	**$6,831.7**	**$7,659.1**	**$21,139.3**

CBNG = coal bed natural gas

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.

Source: PRB Coal Review Task 3C Report (BLM 2005a)

Taxes and mineral royalties levied on energy and mineral resource production accruing to the state are disbursed to the Permanent Water Development Trust Fund, Wyoming School Foundation and Capital Facilities funds, capital construction fund for state and local government facilities, and other programs according to a legislatively-approved formula. Through these funds, the revenues derived from resource development benefit the entire state, not just agencies, businesses, and residents of the PRB.

County governments and school districts would realize benefits from future energy and mineral resource development in the form of ad valorem taxes. Such taxes, estimated on the basis of future coal, oil, and natural gas production, are estimated to range between $5.4 billion and $5.7 billion through 2020. Those sums do not include future property taxes levied on the new power plants, expanded rail facilities, or new residential and commercial development associated with future growth, or sales and use taxes levied on consumer and some industrial purchases. These latter revenues are not estimated in this study but would be substantially lower than those on resource production.

Table 4-36. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production under the Upper Coal Production Scenario (million $)

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total[1]
Coal[1]	$3,538.0	$3,703.0	$4,350.0	$11,591.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$7,021.7**	**$7,355.8**	**$8,252.7**	**$22,630.3**
Severance Tax	$2,104.1	$2,159.0	$2,415.4	$6,678.5
Federal Mineral Royalties	$2,946.3	$3,099.9	$3,461.4	$9,507.6
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$435.8	$472.0	$535.0	$1,442.8
Ad Valorem Tax (Schools)	$1,302.3	$1,398.9	$1,589.8	$4,291.0
Totals	**$7,022.0**	**$7,355.6**	**$8,253.0**	**$22,630.6**

CBNG = coal bed natural gas

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.

Source: PRB Coal Review Task 3C Report (BLM 2005a)

Local governments would benefit from property taxes on new development as well as from sales and use taxes on taxable sales within their boundaries. Such revenues are not estimated for this study due to the large number of jurisdictions and other analytical considerations.

4.2.13.9 Social Setting

The past 30 years have seen sweeping social change in the U.S. and throughout much of the world. But in addition to the broad forces that have driven social change in the U.S. as a whole, social conditions in some PRB communities have been substantially influenced by energy development. Factors that have affected social conditions in the PRB include industrial and natural resource development, economic and demographic change, housing and public infrastructure development, and institutional change at the local and state government levels.

One of the key drivers of social change in the PRB has been energy-related population growth. When the first oil boom occurred in the late 1950s, Campbell County was a relatively stable, sparsely-populated rural county. Like many places in Wyoming and throughout the rural west, Campbell County was a small, relatively homogeneous ranching community (ROMCOE 1982). The oil booms of the 1950s and 1960s brought an influx of new people. Coal mine development, continued oil and gas drilling, and power plant construction precipitated another round of growth. In all, Campbell County population grew by almost 600% between 1950 and 2000.

On the one hand, this population growth, combined with a robust economy, generated a variety of positive social effects. Financial and technical resources poured into the community as it mobilized to accommodate the new population. Job opportunities were created in the construction industry, as the community responded to demands for housing, public facilities, and retail goods and services. The large and rapid influx of new residents created energy, vitality,

and a sense of economic optimism about the community. Where economic advancement had been limited before the boom, there now was opportunity (Gardiner 1985).

On the other hand, it is likely that many residents had mixed feelings about these changes (Heinecke 1985). New residents brought new ideas, new ways of doing things, new preferences for goods and services, and new demands for government services. Some long-time residents, particularly those who were not directly participating in the economic benefits of energy development, viewed these changes as negative.

Today, almost any organization, committee, or government body is made up of a cross-section of energy employees, ranchers, and other community members whose tenure in the community may be long or short (Bigelow pers. comm., Spencer pers. comm.). Moreover, because of the turnover in the energy companies, the community has become accustomed to newcomers.

Cumulative energy development in the PRB through the year 2020 has the potential to generate both beneficial and adverse effects on community social conditions. Social effects of development activities in the PRB would vary from county to county and community to community under the coal production scenarios developed for this study, based on the existing social setting and the type of development that would occur.

Beneficial social effects would be associated with an expanding economy and employment opportunities associated with energy development and resulting improvements in living standards for those employed in energy-related industries. Adverse social effects could occur as a result of conflicts over land use and environmental values. Negative social effects also could occur if the pace of growth exceeds the abilities of affected communities to accommodate energy-related employees and their families with housing and community services.

In the PRB, social conditions in Campbell County, the city of Gillette, and the town of Wright are most likely to be affected because the county would host much of the cumulative energy development workforce, and the county and its municipalities would receive the largest increments in population growth. Campbell County and its municipalities have a long history of energy development, and they have developed infrastructure and management systems to plan for and manage growth; consequently, major adverse social effects would not be anticipated. However, under either scenario, the county and the two municipalities may face challenges in providing adequate housing and expanding community services in anticipation of population growth through 2010, particularly if several power plant and coal mine construction projects occur simultaneously. As municipalities receive only sales and use tax revenues directly from development and purchases made within their boundaries, Gillette and Wright could face challenges in securing the necessary funding to improve municipal facilities and services. Housing shortages and limitations in public services could contribute to adverse community social effects in these communities.

Many of the people who would immigrate to Campbell County for energy-related jobs are likely to share characteristics with much of the current population; therefore, few barriers to social integration are anticipated.

Social effects on other communities in the PRB are likely to be minimal to moderate. Energy-related population growth is anticipated to be moderate in other communities. Sheridan County, also familiar with coal mining, is the only other county anticipated to host a major construction project under the development assumptions used for either projected coal production scenario. Converse, Weston, and Crook counties could experience spillover growth from projects in Campbell County.

Johnson, Sheridan, and Campbell counties could experience continued conflict over split estate and water issues associated with CBNG development. The pace and scale of energy development across the PRB is likely to continue to generate social and political conflict over environmental issues under either coal production scenario.

4.2.14 Coal Mining and Coal-Fired Power Plant Related Emissions and By-Products

As discussed in chapter 1, the BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine. The use of the coal after it is mined is also not determined at the time of leasing; however, almost all of the coal that is being mined in the Wyoming PRB is being used by coal-fired power plants to generate electricity. As a result, a discussion of emissions and by-products that are generated by burning coal to produce electricity is included in this section.

As discussed in chapter 2, under the currently approved mining plan, which represents Alternative 1 (No Action Alternative), from 2009 on, the Buckskin Mine would be able to produce coal at an average production level of 25 million tons per year for another 14 years. Under the Proposed Action and Alternative, production would continue at an average of 25 million tons per year for two years and up to six years, respectively (table 2-5).

Section 3.18.2 contains estimates of GHG emissions resulting from the mining operations at the Buckskin Mine under the Proposed Action and alternatives.

4.2.14.1 Global Climate Change and Greenhouse Gas Emission

Ongoing scientific research has identified the potential impacts of anthropogenic (human-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these changes cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2Eq concentrations to increase dramatically and are likely to contribute to overall global climatic changes. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends (EPA 2008a). Based on the coal- and oil and

gas-related development in the PRB study area, the potential exists for future development of geologic carbon sequestration in the area. However, no commercial projects specifically targeted at capturing and geologic sequestering carbon have been identified at this time. Therefore, carbon sequestration has been eliminated from further consideration in this study.

Climatic change analyses are comprised of several factors, including GHG emissions, land use management practices, and the albedo effect (the cycle of increased temperature of the environment resulting from increased absorption of normally reflected light). In chapter 3, the effects of recent global climate change on the environment in the area of the Proposed Action have been identified. It is assumed that existing land and resource conditions within the analysis area have been and would continue to be affected by climate change under all alternatives. Existing climate forecast models are not at a high enough resolution sufficient to estimate potential impacts of climate change within the Powder River Basin. Reference has been made to national and regional data that is available, including the recent comprehensive report, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States* (U.S. Climate Change Science Program 2008).

Tools necessary to quantify incremental climatic changes associated with those factors for the projected development activities in the PRB are unavailable. Consequently, impact assessments of effects of specific anthropogenic activities cannot be performed. Additionally, specific levels of significance have not been established. Therefore, climate change analysis in this EIS is limited to accounting for and disclosing factors that contribute to climate change. To the extent that emission data were available or could be inferred from representative type data, potential GHG emissions that could result from development of the proposed LBA have been identified, as well as emissions that would result from selection of the no action alternative.

In the following analysis evaluates the contribution of the action alternatives to cumulative effects on the environment of historic and projected development activity. This analysis assumes that coal mining would proceed in accordance with permit conditions, and that the coal would be sold in response to forecasts of demand for the coal. Historically these users have been coal-fired power plants that generate electricity in the U.S., although there is potential for sales outside the U.S. The coal market is open and competitive, and users can buy from the most cost-effective suppliers to meet their needs. The BLM does not determine the destination of this coal, and the use of the coal is determined by the coal consumer. The power plants where this coal has been used are throughout the U.S., and they have a variety of coal combustion technologies and emission controls. All these utility companies are licensed by the appropriate regulatory authorities and operate under necessary permit requirements in compliance with regulations.

Assuming that all coal produced would be burned to generate electricity, the amount of GHG emissions that could be attributed to coal production that could result from leasing of the proposed LBA, as well as from the forecast coal production from all coal mines in the Wyoming PRB has been estimated. This was done by relating the portion of coal mined to the total emission of GHG from all coal mined in the U.S. It is assumed that all PRB coal was used for coal fired electric generation as part of the total U.S. use of coal for electric generation. This

gives an upper estimate of the GHG resulting from use of the coal that would be produced from the proposed LBA, and for forecast total PRB coal production. Specific levels of significance have not been established for GHG emissions, and given the state of the science; it is not yet possible to associate specific actions with the specific climate impacts. Since tools necessary to quantify incremental climatic changes associated with these GHG emissions are presently unavailable, the analysis cannot reach conclusions as to the magnitude or significance of the emissions on climate change. The impacts of climate change represent the cumulative aggregation of all worldwide GHG emissions, land use management practices, and the albedo effect. The analysis does provide a meaningful context and measure of the relative significance of coal use from the proposed LBA and overall projected PRB coal production on total GHG emissions.

The National Assessment of the Potential Consequences of Climate Variability and Change, an interagency effort initiated by Congress under the Global Change Research Act of 1990 (Public Law 101-606), has confirmed that climate change is having impacts on some natural resources that the Department of the Interior has the responsibility to manage and protect (U.S. Department of the Interior 2001). The Synthesis Report, the final part of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (available online at http://www.ipcc.ch), was released in preliminary form on November 17, 2007. The Synthesis Report (Bernstein et al. 2007) summarizes the results of the assessment carried out by the three working groups of the IPCC. Observations and projections addressed in the report include:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising global average sea level."
- "Observational evidence from all continents and most oceans show that many natural systems are being affected by regional climate changes, particularly temperature increases."

From 1850 to present, historic trend data show an increase of 1°C (1.8°F) in global mean temperature. The increase has not been linear over time, and there have been extended periods (decades) where temperature has dropped or stayed constant. This historic warming over that same period has caused sea levels to rise by about 20 centimeters (7.9 inches) on average and has resulted in changes in climate patterns on land. These changes are not uniform. In some areas near the equator, temperatures have cooled by about 5°C (41°F), while closer to the poles, temperatures have risen by equal amounts (Hansen and Lebedeff 1987). In northern latitudes (above 24° N), temperature increases of nearly 1.2°C (2.1°F) have been documented since 1900. Temperature changes can result in shifts of weather patterns (rainfall and winds) which may affect vegetation and habitat. The importance of temperature change and changes in precipitation in species migration and change is being investigated. It is important to note that GHGs will have a sustained climatic impact over different spatial and temporal scales (EPA 2008a).

Variability in radiation output may play a role in global climate change, though the magnitude of the influence of increased sun activity is not well understood. Physical aspects of the sun, like

sunspots and variability in radiation output vary over time. The intensity of energy from the sun has varied through time and has resulted in global temperature variation.

Human population doubled to two billion from the period 1780 to 1930, and then doubled again by 1974. The atmospheric concentrations of GHGs have increased as human populations have increased. More land and resources were used to provide for the needs of these populations. As human activities have increased, carbon-based fuels have been used to provide for those additional energy needs. Forests and vegetation were cleared in order to provide for food production and human use.

CO_2, methane, water vapor, ozone, and N_2O are recognized as the major GHGs, although there are other gases that are considered GHGs. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks have had a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Like glass in a greenhouse, these gases trap radiation from the sun and act as an insulator around the Earth, holding in the planet's heat.

According to the IPCC's synthesis report (Bernstein et al. 2007):

- Global atmospheric concentrations of CO_2, CH_4, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.
- Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. It is likely there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica).
- There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emission will continue to grow over the next few decades.
- Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would be very likely to be larger than those observed during the 20th century.
- There is high confidence that by mid-century, annual river runoff and water availability are projected to increase at high latitudes and in some tropical wet areas and decrease in some dry regions in the mid-latitudes and tropics. There is also high confidence that many semi-arid areas (e.g., Mediterranean Basin, western U.S., southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change.
- Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized.
- Anthropogenic warming and sea level rise could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change.

- There is high agreement and much evidence that all stabilization levels assessed can be achieved by deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades, assuming appropriate and effective incentives are in place for their development, acquisition, deployment and diffusion and addressing related barriers.

The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would not be equally distributed but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict (EPA 2008a).

Relatively steep elevation gradients between valley floors and adjacent mountain ranges in the western U.S. produce considerable geographic climate variability. Warm, dry, semiarid conditions are typical on valley floors; moist and cool conditions are typical in higher parts of mountain ranges. Different plant communities occur within specific elevation zones. There also have been patterns of historic climatic variation in these areas for more than 10,000 years, during which plant communities gradually shift to higher or lower elevations depending on the direction of temperature and precipitation changes (Tausch et al. 2004).

If climate change trends continue into the foreseeable future, Chambers (2006) and the 2008 report by the U.S. Climate Change Science Program (U.S. Climate Change Science Program 2008) indicate that the following changes may be expected to occur in the West:

- The amount and seasonal variability of precipitation would increase over most areas. IPCC (2001) climate model scenarios indicate that by the year 2100, precipitation would increase about 10% in summer, about 30% in fall, and 40% in winter. Less snowfall would accumulate in higher elevations, more precipitation would occur as rain, and snowmelt would occur earlier in the spring because of higher temperatures.
- Streamflow patterns would change in response to reduced snowpack and increasing precipitation. Peak flows in spring are expected to occur earlier and be of lower magnitude because of snowpack changes. Runoff from greater amounts of winter rainfall would cause higher winter flows. Summer flows would be lower, but with higher variability depending on the severity of storm events.
- Some populations of native plants, invasive species, and pests would expand. Increasing amounts of atmospheric carbon dioxide and precipitation during the growing season would provide favorable growth conditions for native grasses, perennial forbs, woody species, and invasive annuals such as cheatgrass. Insect populations also would increase because milder winter temperatures would improve reproduction and survival rates.

- Fire frequency, severity, and extent would increase because of the increased availability of fine fuels (grasses, forbs, and invasives) and accumulation of fuels from previous growing seasons. Higher temperatures would extend the length of fire seasons. Expansion of pinyon-juniper species and increasing tree densities could increase the number of high severity crown fires. Higher rates of insect damage and disease also may increase fuel accumulations.
- Sensitive species and overall biodiversity would be reduced. High-elevation habitats would shrink in area or disappear as lower-elevation plant communities expand. It is probable that some mammalian, avian, and other species that currently inhabit these high-elevation habitats may become extinct. Higher rates of disease and insect damage also may pose threats to other sensitive plant and animal species.

In 2006, transportation sources accounted for approximately 29% of total U.S. GHG emissions (EPA 2008a). Transportation is the fastest growing source of U.S. GHGs, accounting for 47% of the net increase in total U.S. emissions since 1990 (EPA 2008a). Transportation is also the largest end-use source of CO_2, which is the most prevalent anthropogenic GHG (EPA 2008a, National Oceanic and Atmospheric Administration 2009).

Historically, the coal mined in the PRB has been used as one of the sources of fuel to generate electricity in power plants located throughout the U.S.. Coal-fired power plant emissions include CO_2, which has been identified as a principal anthropogenic GHGs. According to the Energy Information Administration (U.S. Department of Energy 2007b, 2007c):

- CO_2 emissions represent about 84% of the total U.S. GHG emissions.
- Estimated CO_2 emissions in the U.S. totaled 5,934.2 million metric tons in 2006, which was a 1.8% decrease from 2005.
- Estimated CO_2 emissions from the electric power sector totaled 2,343.9 million metric tons, or about 39.5% of total U.S. energy-related CO_2 emissions in 2006.
- Estimated CO_2 emissions from coal electric power generation in 2005 totaled 1,937.9 million metric tons or about 33% of total U.S. energy-related CO_2 emissions in 2006.
- Coal production from the Wyoming PRB represented approximately 42% of the coal used for power generation in 2006, which means that Wyoming PRB surface coal mines were responsible for about 13.9% of the estimated U.S. CO_2 emissions in 2006.

Wyoming PRB coal is primarily shipped nationwide, although it can also be shipped overseas. The mines in the Powder River Basin have sold, and are expected to sell coal into the open coal market. Each mine's ability to sell coal in this market would determine annual production rates at that mine. Historically, the coal buyers have been domestic electric producers, although the coal could be used in other coal applications and it has been exported.

Relatively little PRB coal (about 2%) is burned in Wyoming. In 2005, Wyoming coal was shipped to 35 states besides Wyoming. As noted above, coal represented 50.2% of the fuel mix used by electric generators nationally in 2004. In the North American Electric Reliability

Corporation power regions where PRB coal is sold, coal use ranges from 74.2% in the upper Midwest, to 15.6% in the northeast U.S. (EPA 2007c).

There are methods of generating electricity that result in fewer GHG emissions than burning coal, including natural gas, nuclear, hydroelectric, solar, wind, and geothermal resources. However, coal-burning power plants currently supply about 50% of the electric power generated in the U.S. The demand for power is increasing in the U.S. and throughout the world. According to a recent report by the North American Electric Reliability Council, peak demand for electricity in the U.S. is expected to double in the next 22 years (Associated Press 2007a). Many developing countries, including China and India, are also relying heavily on coal to meet their rapidly increasing power demands as coal is more economical and more available than other sources of electrical generation.

Coal sales are made on short-term contracts, generally to individual power generators, or coal is sold on a spot market. This market is very dynamic and competitive. During the coal leasing EIS process, it is uncertain and speculative to predict who might purchase future PRB coal, how it would be used, and where the coal might be transported.

Technologies for producing cleaner, more efficient and more reliable power from coal are becoming more available, although not yet commercially established. These include advanced pulverized coal, circulating fluidized bed, and integrated gasification combined cycle technologies. The FutureGen project proposes to produce electricity by turning coal into gas, remove impurities, extract CO_2 from the waste stream, and then sequester the CO_2 underground. A site in southeastern Illinois was selected for the plant, which has a goal of being operational in 2012 (Biello 2007).

There is no national policy or law that regulates GHG emissions. A number of bills were introduced in the U.S. Congress in 2007 related to global climate change. The Lieberman-Warner Climate Security Act, which was introduced in October, 2007 by Senators Joseph I. Lieberman (ID-CT) and John W. Warner (R-VA), would establish a cap-and-trade within the U.S.. In short, the "cap" would set a legal limit on the quantity of GHGs that a region can emit each year and "trade" would allow companies to exchange the permission – or permits – to emit GHGs. This program would require a 70% reduction in GHG emissions from covered sources, which represents over 80% of total U.S. emissions. It was voted out of the Senate Environment and Public Works Committee in December 2007 (http://www.pewclimate.org, accessed 12/21/2007). The last action on the bill was on May 20, 2008 when it was placed on the Senate Legislative Calendar under General Orders. Additionally, in 2007, the U.S. Supreme Court (*Massachusetts v. EPA*) held that CO_2 qualifies as an air pollutant under the CAA Section 302(g), if EPA determined it to endanger public health or welfare. The case was remanded to EPA to take further action to regulate CO_2 under the CAA unless the EPA determines that CO_2 does not endanger public health or welfare. At this time, EPA has not made that determination.

Federal, state, and local governments are also developing programs and initiatives aimed at reducing energy use and emissions. The 2002 Clear Skies and Global Climate Change Initiative is a voluntary national program to reduce GHGemissions. There are federal tax incentives for

energy efficiency and conservation, and some states have renewable energy and energy efficiency policies. Regional initiatives have started in the northeast (Northeast Regional Greenhouse Gas Initiative) as well as the Western Climate Initiative in the western states. It is impossible to predict how all of these programs would be melded into a national regulatory process if one were to be enacted.

A number of U.S. financial and corporate interests have acknowledged that enactment of federal legislation limiting the emissions of CO_2 and other GHGs seems likely (National Association of Regulatory Utility Commissioners 2007). There is uncertainty about anticipated CO_2 emission limits and carbon capture/sequestration regulations. Some proponents have cancelled or delayed proposed projects that use existing and emerging technologies to produce electricity from coal (Bleizeffer 2007a and 2007b).

The regulatory mechanisms proposed under the Climate Security Act, as well as the past regulation of other pollutants under the CAA, are imposed at the point when coal is burned and converted to electric energy and by-products like CO_2 and other compounds. Over 95% of coal produced in the PRB is sold in an open market where coal is purchased on short term contracts or spot prices based on a coal feed stock that is suitable for each buyer's power generating facility. Coal production at any one mine is not tied in any predictable way over a period to any one power plant. Power plant buyers attempt to buy coal at the most economical prices that meet their needs. PRB coal has competed well in this market due to its low sulfur content. This makes it valuable in lowering sulfur dioxide pollution, as well as competitive mining costs when compared to delivered costs of coal from other coal producing areas.

U.S. coal production increased from 1,029.1 million tons in 1990, when the Powder River Federal Coal Region was decertified, to 1,161.4 million tons in 2006, an increase of 12.9% (U.S. Department of Energy 2007c). Wyoming coal production increased from 184.0 million tons in 1990 to 444.9 million tons in 2006, an increase of 242% (Wyoming Department of Employment 2007). The share of electric power generated by burning coal was consistently around 50% during that time. Also, the percentage of total U.S. CO_2 emissions related to coal consumption was consistently around 36% during that same time. The percentage of U.S. CO_2 emissions related to the coal electric power sector increased from about 31% in 1990 to about 33% in 2006 (U.S. Department of Energy 2007b, 2007c).

In 2006, the Wyoming Powder River Basin coal mines produced approximately 432.0 million tons of coal. Using factors derived from laboratory analyses, it is estimated that approximately 716.9 million metric tons of CO_2 would be generated from the combustion of all of this coal (before CO_2 reduction technologies are applied). This number is based on an average Btu value of 8,600 per pound of Wyoming coal using a CO_2 emission factor of 212.7 pounds of CO_2 per million Btu (U.S. Department of Energy 1994). The estimated 716.9 million metric tons of CO_2 represents approximately 33.6% of the estimated 2,134.1 million metric tons of U.S. CO_2 emission from coal combustion (U.S. Department of Energy 2007c). In 2006, Wyoming PRB mines accounted for approximately 37.2% of the coal produced in the U.S. (U.S. Department of Energy 2007d).

Table 4-37 shows the estimated cumulative annual CO_2Eq emissions produced by all mines in the PRB with pending LBAs. The cumulative emissions calculated are those associated with the actual mining operations and not from the combustion of the coal produced and sold on the open coal market. For more information on the LBAs, please see the individual EISs (South Gillette Area Coal EIS, Wright Area Coal EIS, and West Antelope II EIS).

Table 4-37. Estimated Annual Equivalent CO_2 Emissions (metric tons) from Coal Production at Mines with Pending LBAs

Source	2007	With LBA Tracts
South Gillette area coal mines/LBA tracts	716,210	1,181,920
Wright area coal mines/LBA tracts	1,245,241	2,502,889
Antelope Mine/West Antelope II LBA tract	225,223	347,911
Buckskin Mine/Hay Creek II LBA tract	196,576	196,576
Total	**2,534,585**	**4,229,296**

CO_2 = carbon dioxide; LBA = lease by application

Source: BLM 2008e; IML Air Science 2009; Western Water Consultants 2009a, 2009b.

Wyoming coal production has increased at a more rapid rate than other domestic coal. Wyoming coal is low in sulfur, providing a way for electric generators to achieve acid rain reduction requirements. Coal coming out of the Wyoming PRB is mined using surface mining methods which are generally safer and less labor intensive than underground mining. Rural rangelands are the areas that are mainly mined; they are reclaimed according to the WDEQ/LQD's standards (see section 3.9.4). PRB coal reserves are in thick seams, resulting in more production from areas of similar land disturbance, and lower mining and reclamation costs.

As discussed earlier in this chapter, future coal mining impacts are estimated based on two forecast scenarios for PRB coal production through 2020. In the low scenario, the percentage of coal use for electric generation would stay about the same, assuming that all forms of electric generation would grow at a proportional rate to meet forecast electric demand. In the high scenario, percentage of coal use would also remain about the same, but with PRB coal displacing coal from other domestic coal regions.

If public behavior results in changed electric demand, or if GHG emissions are regulated, the demand forecast for coal for electric generation could change. The DOE has forecasted that the coal share of total energy use would increase from 23% in 2006 to 25% in 2030, while the share of natural gas would fall from 22% to 20%, and the liquids share is predicted to fall from 40% to 37%. The combined share of carbon-neutral renewable and nuclear energy is forecasted to grow from 15% in 2006 to 17% in 2030.

Taken together, projected growth in the absolute amount of primary energy consumption and a shift toward a fuel mix with slightly lower average carbon content would cause projected energy-related emissions of CO_2 to grow by 16% from 2006 to 2030. This is slightly lower than the projected 19% increase in total energy use. Over the same period, the economy would

become less carbon-intensive, because the 16% increase in CO_2 emissions is about one-fifth of the projected increase in GDP (79%), and emissions per capita decline by 5%.

In the 2008 study, projected energy-related CO_2 emissions grew from 5,890 million metric tons in 2006 to 6,851 million metric tons in 2030. In the Annual Energy Outlook 2008 study, energy-related CO_2 emissions were projected to grow by about 35%, to 7,950 million metric tons in 2030. This reflects both a higher projection of overall energy use and, to a lesser extent, a different mix of energy sources (U.S. Department of Energy 2008c). This forecast is within the range of the high and low scenarios presented in chapter 4.

The Annual Energy Outlook 2008 report projected that energy-related emissions of CO_2 would grow by 16% from 2006 to 2030. In this projection, the mix of sources for this generation include coal, natural gas, nuclear, liquids (petroleum), hydro-power, and non-hydro renewable (wind, solar, etc.). The forecasted generation mix by 2030 as compared to 2007 is included in table 4-38.

Table 4-38. Projected Percent of CO_2 Emissions by Source (2007 and 2030)

Source	2007	2030
Coal	51%	58%
Nuclear	21%	19%
Natural Gas	18%	11%
Petroleum	1%	1%
Hydro Power	7%	6%
Renewables	2%	5%

CO_2 = carbon dioxide

The Electric Power Research Institute (EPRI) attempted to identify a scenario of how the full portfolio of technologies to provide for electric energy would respond if national policy were to require that CO_2 emissions be reduced to 1990 levels (James 2007). As noted earlier, there is no regulatory structure or CO_2 emission levels or limits that have been set by national policy or law. This scenario provides some analysis of the possible effect of regulation as well as decreased demand through energy efficiency at the user end, in transmission, and at the producer end. The forecasted generation mix by 2030 as compared to 2007 is included in table 4-39.

Table 4-39. Projected Percent of CO_2 Emissions by Source (2007 and 2030) Under a Reduced CO_2 Emissions Scenario

Source	2007	2030
Coal	51%	52%
Nuclear	21%	29%
Natural Gas	18%	5%
Petroleum	1%	0%
Hydro Power	7%	5%
Renewables	2%	9%

CO_2 = carbon dioxide

The EPRI study predicts that national policy that forces a reduction of CO_2 emissions to 1990 levels would promote increased energy efficiency, and the growth of "non carbon" sources such as nuclear and renewable. Renewable sources include wind and solar, as well as emerging technologies like tidal power, river turbines, and others reported in the media. Hydropower is limited because most opportunities for hydropower have been used or require large infrastructure. Use of carbon based sources such as natural gas and petroleum are less than forecasted by the Energy Information Administration, while coal use remains about the same in the EPRI forecast, mostly due to forecasted improvement in GHG emission reduction in coal fueled generation. Both the Energy Information Administration and EPRI forecast increases in electricity cost.

The mines in the PRB have sold and are expected to sell coal into the open coal market. In both Energy Information Administration market projections and market projections that contemplate CO_2 regulation, the coal market supplies half or more of the electric generation mix through 2020. Each mine's ability to sell coal in this market would determine annual production rates at that mine. Historically, the coal buyers have been domestic electric producers, although the coal could be used in other coal applications or be exported.

The Buckskin Mine produced approximately 22.8 million tons of coal in 2006, which represents about 5.3% of the coal produced in the Wyoming PRB in 2006, or about 0.74 percent of the estimated U.S. CO_2 emissions in 2006. Under the No Action Alternative, CO_2 emissions attributable to burning coal produced by the Buckskin Mine would be extended at about this level for approximately 14 years, while the mine recovers the remaining estimated 344.3 million tons of currently leased coal reserves. It is likely that, by that time, regulations limiting CO_2 emissions will be in place and, potentially, projects using the emerging technologies to reduce and/or sequester CO_2 emissions would be more established.

Section 3.18.2 contains estimates of GHG emissions that would result from the mining operations under the action alternatives.

Under the action alternatives, the Buckskin Mine anticipates that the average annual rate of coal production will remain at 25 million tons per year, well below the permitted rate of 42 million

tons per year. Mining associated with a new maintenance tract would continue to use existing production and transportation facilities, which would extend CO_2 emissions related to burning coal from the mine for up to six additional years beyond December 2008. It is not possible to project the level of CO_2 emissions that burning the coal would produce due to the uncertainties about what emission limits will be in place at that time or where and how the coal in the tract would be used after it is mined. It is not likely that selection of the No Action Alternative would result in a decrease of U.S. CO_2 emissions attributable to coal-burning power plants in the longer term. There are multiple other sources of coal that, while not having the cost, environmental, or safety advantages, could meet the demand for coal beyond the time that the Buckskin Mine completes recovery of the coal in their existing leases.

CBNG, which is composed primarily of methane, another GHG, is released into the atmosphere when coal is mined. According to the U.S. Energy Information Administration (U.S. Department of Energy 2007a and 2007b):

- U.S. anthropogenic (human-caused) methane emissions totaled 605 million metric tons CO_2 equivalent in 2006.
- U.S. 2006 methane emissions from coal mining were estimated at 64.7 million metric tons CO_2 equivalent, which represents approximately 10.7% of the U.S. total anthropogenic methane emissions in 2006.
- Surface coal mining operations in the U.S. were estimated to be responsible for methane emissions of about 14.2 million metric tons of CO_2 equivalent in 2006, which represents about 2.35% of the estimated U.S. anthropogenic methane emissions in 2006, and about 22% of the estimated methane emissions attributed to coal mining of all types.
- The Wyoming PRB produced approximately 53.7% of the coal mined in the U.S. in 2006 using surface mining techniques, which means that Wyoming PRB surface coal mines were responsible for approximately 1.26% of the estimated U.S. anthropomorphic methane emissions in 2006. The Buckskin Mine contributed about 5.3 percent of the Wyoming PRB production in 2006.

When BLM began using the LBA process in 1990, total U.S. anthropogenic methane emissions declined from 708.4 million metric tons CO_2 equivalent to 605.1 million metric tons CO_2 equivalent in 2006. Total coal mining related emissions declined from 97.7 million metric tons CO_2 equivalent to 64.7 million metric tons CO_2 equivalent during the same time. The Energy Information Administration (U.S. Department of Energy 2007b) attributes the overall decrease in coal mine emissions of methane since 1990 to the fact that the coal production increases during that time had been largely from surface coal mines that produce relatively little methane.

CBNG is being commercially produced from wells in the general analysis area. CBNG that is not recovered before mining would be vented to the atmosphere during the mining process. Selection of the No Action Alternative would potentially allow more complete recovery of the CBNG from the general analysis area in the short term (10 years), during the time that the mine's currently leased coal is being recovered. However, the BLM's analysis suggests that a large

portion of the CBNG resources that are present in the general analysis area would be recovered prior to mining under either of the action alternatives. Selection of the No Action Alternative would not be likely to directly decrease U.S. methane emissions attributable to coal mining in the long term because there are multiple other sources of coal that could supply the coal demand beyond the time that the Buckskin Mine recovers the coal in their existing leases.

4.2.14.2 Mercury, Coal Combustion Residues, and Other By-Products

To meet the nationwide consumer demand and requirement for energy, coal is burned in power plants to produce electricity in the U.S. Coal is an important component of the U.S. energy supply partly because it is the most abundant domestically available fossil fuel (USGS 2002b). One-quarter of the world's coal reserves are found within the U.S. (U.S. Department of Energy 2008b); the energy content of U.S. coal resources exceeds that of the entire world's known recoverable oil (U.S. Department of Energy 2008b). Coal resources supply more than half of the electricity consumed by Americans (U.S. Department of Energy 2008b). Many countries are even more reliant on coal for their energy needs than is the U.S. (USGS 2000). More than 70% of the electricity generated in China and India comes from coal (USGS 2000). The value of coal is partially offset by the environmental impacts of coal combustion (USGS 2000). As described below, some of these impacts may have direct or indirect effects on human health (USGS 2000).

One of the concerns associated with burning coal for electricity production is the release of elements from coal to the environment (USGS 2002b). When coal is burned, carbon dioxide, sulfur dioxide, nitrogen oxides, mercury, and other compounds and elements, including lead and cadmium, are released (EPA 2007d). The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur and nitrogen oxides, trace elements (including arsenic, fluorine, selenium, and radioactive uranium and thorium), and organic compounds generated by incomplete coal combustion (USGS 2000).

Concentrations of these elements and compounds vary depending on the chemistry of the coal deposits and the type of air pollution controls in place when the coal is burned. Coal use in developing countries can potentially cause serious human health impacts (USGS 2000). Some coal mined in China caused severe health problems in several local populations because the coal was mined and burned with little regard to its chemical composition (USGS 2000). Chinese coals that contained high levels of arsenic, fluorine, selenium, and polycyclic aromatic hydrocarbons have caused severe, life-threatening health impacts on some residents that burned the coal in unvented stoves in their homes (USGS 2000).

Coal that is burned in the U.S. generally contains low to modest concentrations of potentially toxic trace elements and sulfur (USGS 2000). Powder River Basin coal is recognized as being a clean burning coal because of its low sulfur and low ash properties. An analysis conducted by the USGS (2002b) found that PRB coal contained, on average, approximately eight times less sulfur than coals being used from the Appalachian and Illinois basins to supply U.S. power plants (feed coal). PRB feed coal was also found to contain nearly half as much uranium (8.9 parts per million), seven times less arsenic (17 parts per million), five times less lead (19 parts per million), and three times less cadmium (1.1 parts per million) when compared to

Appalachian and Illinois basin feed coals. When burned, PRB coal produced, on average, 38% less fly ash than Appalachian and Illinois basin coals (USGS 2002b). The fly ash resulting from combusted PRB coal contained approximately 39 times less mercury than fly ash that was generated from combusted Appalachian and Illinois basin coal (USGS 2002b).

Additionally, many U.S. coal burning power plants use sophisticated pollution-control systems that efficiently reduce the emission of hazardous elements (USGS 2000). The EPA conducted a detailed study of possible health impacts from exposure to emissions of approximately 20 potentially toxic substances from U.S. coal-burning power plants (USGS 2000). The EPA concluded that, with the exception of possibly mercury, there is no compelling evidence to indicate that emissions from U.S. coal-burning power plants cause human health problems (USGS 2000).

Mercury is a naturally occurring element and enters the atmosphere from natural sources, such as active volcanoes, and through human activities such as industrial combustion and mining (EPA 2006). Natural sources of mercury, such as volcanic eruptions and emissions from the ocean, have been estimated to contribute about 33% of the current worldwide mercury air emissions; anthropogenic (human-caused) mercury emissions account for the remaining 67%, though these estimates are highly uncertain (EPA 2007e).

When fossil fuels burn, mercury vapor can be released into the atmosphere where it may drift for a year or more, spreading with air currents over vast regions of the globe (U.S. Department of Energy 2006). In 1995, an estimated 5,500 tons of mercury was emitted globally from both natural and human sources (U.S. Department of Energy 2006). Coal-fired power plants in the U.S. contributed to less than 1% of that total (U.S. Department of Energy 2006).

Mercury is a global problem that knows no national or continental boundaries. It can travel thousands of miles in the atmosphere before it is eventually deposited back to the earth in rainfall or in dry gaseous forms (EPA 2007e). EPA estimates that about one-third of the U.S. human-caused mercury emissions are deposited within the contiguous U.S. and the remainder enters the global cycle (EPA 2007e).

Table 4-40 summarizes how the various continents contributed to worldwide human-caused mercury emissions in 2004. The 2004 emissions were estimated to account for about 3% of the global total (EPA 2007e). EPA (2006a) estimates that 83% of the mercury deposited in the U.S. originates from international sources, with the remaining 17% coming from the U.S. and Canada. These figures include mercury from natural and human-caused sources.

Table 4-40. 2004 Percent Contribution to Worldwide Anthropogenic Mercury Emissions

Continent	Percent
Asia:	53%
Africa:	18%
Europe:	11%
North America:	9%
Australia:	6%
South America;	4%

Source: EPA 2007e

In 2006, EPA estimated that 50% to 70% of global human-caused atmospheric emissions came from fuel combustion, and much of it came from China, India, and other Asian countries (EPA 2006). Coal consumption in Asia is expected to grow significantly over the next 20 years (EPA 2006). This international source of mercury emissions may grow substantially if left unaddressed (EPA 2006).

Over the past decade, addressing environmental and human health mercury risks has been a focus for EPA (EPA 2006). Overall U.S. mercury air emissions have been reduced by 45% since 1990 (EPA 2006). EPA is most concerned with methyl mercury, a potent form of mercury and the form to which humans are primarily exposed (EPA 2006).

Atmospheric mercury can settle into water or onto land where it can be washed into the water. Certain microorganisms can transform mercury into methyl mercury, a highly toxic mercury compound that builds up in fish and shellfish when they feed. Methyl mercury is the only form of mercury that biomagnifies in the food web. Concentrations of methyl mercury in fish are generally on the order of a million times the methyl mercury concentration in the water (EPA 2006). The primary pathway of human exposure to mercury is through eating fish containing methyl mercury (EPA 2006).

There are adverse health effects to humans and other animals that consume these fish and shellfish. Birds and mammals that eat fish may be more exposed to mercury more than other animals in water ecosystems (EPA 2008b). At high levels of exposure, methyl mercury's harmful effects may include death, reduced reproduction, slower growth and development, and abnormal behavior (EPA 2008b). Research has shown that most people's fish consumption does not cause a health concern, but high levels of methyl mercury in the bloodstream of unborn babies and young children may harm the developing nervous systems of those children (EPA 2006).

DOE's Office of Fossil Energy has been sponsoring studies on mercury emissions from coal-based power generators to identify effective and economical control options for the past decade (U.S. Department of Energy 2006). The Office of Fossil Energy manages the largest funded program in the U.S. for developing an understanding of mercury emissions and developing emission control technologies for the coal-fired electric generating industry in the

U.S. (U.S. Department of Energy 2006). Research on advanced and improved mercury control technology is ongoing (U.S. Department of Energy 2006).

In the U.S., coal-burning power plants are the largest human-caused source of mercury emissions being released into the air, accounting for about 40% of all domestic human-caused mercury emissions (EPA 2008b). However, these emissions contribute little to the global mercury pool. EPA estimated that mercury emissions from U.S. coal-fired power plants account for about 1% of the global total (EPA 2007e).

Coal production from the Wyoming PRB represented approximately 42% of the coal used for power generation in 2006, which would represent about 0.4% of the global anthropogenic mercury emissions. The Buckskin Mine produced about 5.3% of the coal produced in the Wyoming PRB in 2006, which would represent about 0.02% of the global mercury emissions. Under the No Action Alternatives, mercury emissions attributable to burning coal produced by the Buckskin Mine would be extended at current levels up to approximately 14 years, while the mine recovers the remaining estimated 344.3 million tons of currently leased coal reserves. Under the Proposed Action or Alternative 2, the Buckskin Mine's contribution to global mercury emissions would be extended from two to six additional years, respectively. Uncertainties about future regulatory requirements and the use of the coal mined under either of the action alternative make it difficult to project the impacts of mercury emissions produced by burning the coal.

Additionally, burning coal in electric utility boilers generates residual materials called coal combustion residues. These residues include non-combustible materials left in the furnaces and ash that is carried up the smokestacks and collected by air pollution control technologies. As previously referenced, coal and coal combustion residues can contain a variety of compounds, metals, and other elements depending on the coal deposit and the site-specific characteristics of where the coal originated. Coal-fired boilers are required to have control devices to reduce the amount of emissions that are released into the atmosphere (EPA 2007d). The use of air pollution control equipment at power plants has resulted in fewer emissions but has also increased the amount of solid residues.

In the past, coal combustion residues have been recycled or disposed of in landfills or surface impoundments. More recently, these residues have been disposed of in mines. There can potentially be risks of contamination of drinking water supplies and surface water bodies by coal combustion residues, particularly when they are disposed of in mines (National Academy of Science 2006, EPA 2002). The EPA is evaluating management options for solid wastes from coal combustion, including whether current management practices pose risks to human health or ecological receptors. A draft report, dated August 6, 2007, prepared for the EPA Office of Solid Waste, and entitled "Human and Ecological Risk Assessment of Coal Combustion Wastes", is available at http://www.earthjustice.org/library; however, the report is labeled as a draft document which is not to be cited or quoted.

As stated, the Buckskin Mine produced about 5.3% of the coal produced in the Wyoming PRB in 2006. Under the No Action Alternative, production of coal combustion residue attributable to

burning coal from the Buckskin Mine would be extended at about current levels for up to approximately 14 years, while the mine recovers the remaining estimated 344.3 million tons of currently leased coal reserves. Coal combustion residue related to burning coal mined under the Proposed Action or Alternative 2 would be extended from two to six additional years, respectively. Uncertainties about future regulatory requirements and the use of the coal mined under either action alternative make it difficult to project the impacts of disposing of the related coal combustion residues.

Depending on the size, shape, and chemical composition, some coal combustion residues can be recycled and beneficially reused as components of building materials or as replacement to raw materials that would ordinarily need to be mined (e.g., sand, gravel, or gypsum) (EPA 2007f). Coal combustion products (CCPs) are produced primarily from the combustion of coal in coal-fired power plants (EPA 2007f) and can include the following materials: fly ash, bottom ash, boiler slag, and flue gas desulfurization material (EPA 2007f). Studies and research conducted or supported by the EPA, EPRI, other government agencies, and universities have indicated that the beneficial uses of coal combustion products have not been shown to present significant risks to human health or the environment (EPA 2009c).

Fly ash is a byproduct of burning finely ground coal in a boiler to produce electricity (EPA 2007g). Physically, fly ash is a fine, powdery material composed mostly of silica and nearly all particles are spherical in shape (EPA 2007g). Fly ash is a pozzolan—a siliceous material which, in the presence of water, will react with calcium hydroxide at ordinary temperatures to produce cement-like compounds (EPA 2007g). Because of its spherical shape and pozzolanic properties, fly ash can be useful in cement and concrete applications (EPA 2007g).

Bottom ash is agglomerated ash particles, formed in furnaces burning pulverized coal that are too large to be carried in the flue gases (EPA 2007h). Bottom ash is coarse with grain sizes from fine sand to fine gravel (EPA 2007h). It can be used as a replacement for aggregate and is usually sufficiently well-graded in size to avoid the need for blending with other fine aggregates to meet gradation requirements (EPA 2007h).

Boiler slag is the molten bottom ash collected at the base of slag tap and cyclone type furnaces (EPA 2007i). Boiler slag particles are uniform in size, hard, and durable with a resistance to surface wear (EPA 2007i). The permanent black color of this material is desirable for asphalt applications and aids in melting snow (EPA 2007i).

Flue gas desulfurization is the technology used for removing or reducing SO_2 emissions from the exhaust gas system of a coal-fired boiler (EPA 2007j). SO_2 is an acid gas and the typical materials used to remove the SO_2 from the flue gasses are alkaline. The reaction taking place in wet scrubbing uses a limestone slurry and produces calcium sulfate. When magnesium hydroxide is used as a scrubber, magnesium sulfate is produced. These materials can be used as embankment and road base material, wallboard manufacturing, and in place of gypsum for the production of cement (EPA 2007j). Currently, the largest single market for flue gas desulfurization material is in wallboard manufacturing (EPA 2007j).

Using or recycling CCPs can generate significant environmental and economic benefits (EPA 2007f). CCPs can be used for raw feed for cement clinker, concrete, grout, flowable fill, structural fill, road base/sub-base, soil modification, mineral filler, snow and ice traction control, blasting grit and abrasives, roofing granules, mining applications, wallboard, waste stabilization/solidification, and soil amendment (EPA 2007f).

Using CCPs can reduce energy consumption and GHG emissions and can help reduce the need for landfill space (EPA 2009c). Economic benefits include reduced costs associated with managing coal ash and slag disposal, potential revenue from the sale of CCPs, and savings from using CCPs in place of other more costly raw materials (EPA 2003b).

CCPs offer product-performance benefits as well. Boiler slag is a sought-after replacement for sand in blasting grit because it is free of silica and eliminates the potential health risk of silicosis (EPA 2009c). High coal ash content concrete is used for building pavements designed to last 50 years—twice the lifetime of conventional pavements (EPA 2003b). Coal fly ash can create superior products because of its self-cementing properties (EPA 2007g). Using coal fly ash in concrete can also produce stronger and longer-lasting buildings (EPA 2007g). This not only reduces the costs of maintaining buildings, but provides the additional environmental benefit of reducing the need for new concrete to repair or replace aging buildings. This translates to a significant reduction in future energy consumption and GHG emissions (EPA 2007g).

In 2005, demand had become so strong for coal ash that some power plants were selling all the ash they produced (EPA 2005b). EPA (2008e) estimated that through the use of 15 million tons of coal fly ash, the U.S. reduced their GHG emissions equivalent to the annual emissions of nearly 2.5 million passenger vehicles.

Because of the many potential uses of CCPs, EPA has sponsored the Coal Combustion Products Partnership (C2P2) Program to further the beneficial use of these coal combustion by-products (EPA 2003b). With more than 170 private and public partners (EPA 2009c), the C2P2 Program is a cooperative effort between EPA and various organizations to help promote the beneficial use of CCPs and the environmental benefits which can result from the proper use of these potentially recyclable materials (EPA 2003b). The C2P2 program will help meet the national waste reduction goals of the Resource Conservation Challenge—an EPA effort to find flexible yet more protective ways to conserve valuable natural resources through waste reduction, energy recovery, and recycling (EPA 2009c).

In 2007, the U.S. used approximately 43% of its coal combustion products (EPA 2009c). The C2P2 program aims to reduce adverse effects on air and land by increasing the use of coal combustion products to 50% in 2011 from 31% in 2001 (EPA 2009c). The program also plans to increase the use of CCPs as a supplementary cement-like material in concrete by 50%, from 12.4 million tons in 2001 to 18.6 million tons in 2011 (EPA 2009c). This would decrease GHG emissions from avoided cement manufacturing by approximately 5 million tons (EPA 2008a).

Table 4-41 summarizes the magnitude and duration of cumulative impacts in the PRB based on the upper and lower estimates for coal production in the region. The Proposed Action and

Alternative 2 are within the upper and lower coal production estimates used to project reasonably foreseeable impacts for the PRB Coal Review and to provide a basis for quantification of related impact-causing parameters. As described in section 4.0, the PRB Coal Review is not an analysis of the impacts associated with the development of a specific project in the PRB, such as the Hay Creek II coal lease application discussed in this EIS.

Table 4-41. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1,2]

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Topography and Physiography		
Alteration of topography following reclamation of coal disturbance areas	Permanent topographic moderation following reclamation	Same as No Action
Alteration of topography to accommodate coal-related, oil and gas, and oil-and-gas-related facilities	Long-term to permanent limited changes in discrete, scattered areas	Same as No Action
Geology and Minerals		
Recovery of coal resulting in reduction in coal resources and disturbance and replacement of overburden and topsoil	Moderate, long-term to permanent	Same as No Action
Surficial disturbance and reclamation on oil and gas well sites and associated facilities	Moderate, long-term to permanent	Same as No Action
Paleontology		
Coal, coal-related, oil and gas, and oil-and-gas-related development disturbance of BLM's potential fossil yield classification class 4 Fort Union and class 3a Wasatch formations	Permanent potential adverse effects to scientifically significant fossils that are present but not visible prior to disturbance	Same as No Action

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Air Quality		
Impacts on Montana near-field receptors ▪ 24 hour PM_{10}	A maximum modeled impact in one area NAAQS for the baseline year and both coal production scenarios for 2010	Same as No Action
▪ All other parameters	Modeled impacts in compliance with NAAQS and Montana AAQS	Same as No Action
Impacts on Wyoming near-field receptors ▪ 24 hour PM_{10}	Modeled impact above NAAQS at some receptors for both coal production scenarios for 2010	Same as No Action
▪ Annual PM_{10}	Maximum modeled impact above Wyoming AAQS at one receptor for the upper production scenario for 2010	Same as No Action
▪ All other parameters	Modeled impacts in compliance with NAAQS and Wyoming AAQS	Same as No Action
Non-regulatory prevention of significant deterioration impacts at class I and sensitive class II Areas		
▪ Class I Northern Cheyenne Indian Reservation	Modeled impacts above class I increment levels for 24-hour PM_{10}, annual PM_{10}, 24-hour SO_2, 3-hour SO_2 for baseline year and both coal production scenarios for 2010; above class I increment for annual NO_2 for upper coal production scenario for 2010	Same as No Action
▪ Class I Washakie Wilderness Area and Wind Cave National Park and class II Crow Indian Reservation	Modeled impacts above class I increment levels for 24-hour PM_{10} for baseline year and both coal production scenarios for 2010	Same as No Action
▪ All other class I and sensitive class II modeled receptors	Modeled impacts within class I increment levels for baseline year and both coal production scenarios for 2010	Same as No Action
Visibility Impacts	199 or more days with a change of 1.0 deciview or greater at three class I areas and seven sensitive class II areas for the baseline year and both coal production scenarios for 2010	Same as No Action
Acid deposition impacts	All modeled impacts below the depositions threshold values for nitrogen and sulfur compounds	Same as No Action
▪ Florence Lake	Modeled impact above 10% acidification neutralization capacity	Same as No Action
▪ Upper Frozen Lake	Modeled impact above 1 microequivalent per liter	Same as No Action
▪ All other modeled sensitive lakes	Modeled impact below threshold values	Same as No Action

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Groundwater Resources		
Removal of coal aquifer and replacement with backfill material	Moderate, permanent for mining areas	Same as No Action
Lowering of water levels in aquifers around the mines	Moderate, long-term in area immediately west of mines	Same as No Action
Water level decline sub-coal aquifers as a result of all development	No cumulative impacts anticipated	Same as No Action
Change in groundwater quality as a result of all development	No cumulative impacts anticipated	Same as No Action
Overlapping drawdown in the coal aquifer caused by surface mining and CBNG development	Additive, long-term in area immediately west of surface coal mines	Same as No Action
Surface Water Resources		
Surface disturbance of intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term	Same as No Action
Discharge of coal mining and CBNG produced waters into intermittent and ephemeral streams	Moderate, short-term	Same as No Action
Sediment input into intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term	Same as No Action
Alluvial Valley Floors		
Coal mining disturbance of AVFs determined to be significant to agriculture	Not permitted by regulation	Same as No Action
Coal mining disturbance of AVFs determined not to be significant to agriculture	AVFs disturbed by mining must be restored to essential hydrologic function No cumulative impacts anticipated	Same as No Action
Soils		
Coal mining, coal-related, oil and gas, and oil-and-gas-related development and replacement of soil resources	Moderate, short-term and long-term impacts through accelerated wind or water erosion, declining soil quality factors through compaction, reduced microbial populations and organic matter, and potential mixing of soil zones	Same as No Action
CBNG water disposal impacts on soil resources	Potential increase in soil alkalinity depending on sodium absorption rate levels in water and method of water disposal	Same as No Action

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Vegetation		
Coal mining, coal-related, oil and gas, and oil-and-gas-related development and replacement of native vegetation	Moderate, short- to long-term impacts due to potential differences in species composition and presence and size of woody species on reclaimed lands	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related impacts on special status plant species	Potential incremental loss or alteration of potential or known habitat	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related dispersal of noxious and invasive species	Potential displacement of native species and changes in species composition	Same as No Action
Wetlands and Riparian Vegetation		
CBNG-related discharge of produced water	Moderate, short- to long-term creation of wetlands in areas that previously supported upland vegetation	Same as No Action
Wildlife		
Direct and indirect coal mining, coal-related, oil and gas, and oil-and-gas-related development impacts on game and non-game species, including direct mortality, habitat fragmentation, animal displacement, noise, and increased human presence	Moderate, short-term	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related disturbance of game and non-game species during project development and operation	Moderate, short-term loss of all types of habitat present in disturbed areas	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related habitat changes after reclamation	Moderate, long-term change in habitat with potential changes in associated wildlife populations	Same as No Action
Fisheries		
Alteration or loss of habitat due to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short- to long-term	Same as No Action
Changes in water quality as a result of surface disturbance or introduction of contaminants into drainages caused by coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short- to long-term	Same as No Action
Changes in available habitat as a result of water withdrawals or discharges related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term	Same as No Action

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Special Status Species		
Direct and indirect coal mining, coal-related, oil and gas, and oil-and-gas-related development impacts, including direct mortality, breeding area, nest, or burrow abandonment, noise, and increased human presence	Moderate, short-term	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related disturbance of habitat during project development and operation	Moderate, short-term loss of all types of special status species habitat present in disturbed areas	Same as No Action
Coal mining, coal-related, oil and gas, and oil-and-gas-related habitat changes after reclamation	Moderate, long-term change in habitat with potential changes in associated populations of special status species	Same as No Action
Land Use and Recreation		
Loss of forage and range improvements and restriction of livestock movement due to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term	Same as No Action
Disturbance of developed recreation sites by coal mining, coal-related, oil and gas, and oil-and-gas-related development	Negligible, short-term	Same as No Action
Reduction or degradation of opportunities for dispersed recreation activities related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term on existing mine area	Same as No Action
Cultural Resources		
Disturbance of cultural resource sites	Moderate, permanent	Same as No Action
Transportation and Utilities		
Movement of segments of existing highways, pipelines, transmission lines, or railroads to accommodate coal mining development	Moderate, long-term to permanent, disruptive effects would be minimized	Same as No Action
Increased vehicular traffic on roads and highways due to coal mining, coal-related, oil and gas, and oil-and-gas-related development, and associated impacts including traffic accidents, road wear, air emissions, dust, noise, and vehicle collisions with wildlife and livestock	Moderate, short-term	Same as No Action
Construction and operation of additional railroad and pipeline facilities and transmission lines to transport coal, oil and gas, and electricity	Moderate, short- to long-term	Same as No Action

Description of Potential Impact by Resource	Magnitude and Duration of Impact: No Action Alternative	Magnitude and Duration of Impact: Proposed Action and Alternative 2[3]
Socioeconomics		
Increases in employment related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Significant, short- to long-term	Same as No Action
Increases in personal income due to employment increases related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Significant, beneficial, short- to long-term	Same as No Action
Increase in population due to employment increases related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Significant, short- to long-term	Same as No Action
Expansion of housing supply due to employment increases related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Significant, short- to long-term	Same as No Action
Increases in school enrollment due to employment increases related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short-term	Same as No Action
Need for additional local government facilities and services due to employment increases related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Moderate, short- to long-term	Same as No Action
Increased federal, state, and local revenues related to coal mining, coal-related, oil and gas, and oil-and-gas-related development	Significant, beneficial, short- to long-term	Same as No Action

NAAQS = National Ambient Air Quality Standards; AAQS = Ambient Air Quality Standards; SO_2 = sulfur dioxide; AVF = alluvial valley floor.

[1] The cumulative impacts identified in this table are based on the Powder River Basin Coal Review analyses (BLM 2005a–f, 2006c–d). The PRB Coal Review is a regional technical study to assess current conditions (Task 1 reports), identify reasonably foreseeable development actions and future coal production scenarios (Task 2 report), and predict future cumulative impacts (Task 3 reports) in the PRB. The PRB Coal Review is not an analysis of the impacts associated with the development of a specific project in the PRB, such as the Hay Creek II coal lease application discussed in this EIS.

[2] All impacts are assumed to be adverse unless noted otherwise.

[3] The Proposed Action and Alternative 2 are within the upper and lower coal production estimates used to project reasonably foreseeable impacts for the PRB Coal Review and to provide a basis for quantification of related impact-causing parameters.

5.0 CONSULTATION AND COORDINATION

In addition to this EIS[1], other factors and consultations are considered and play a major role in determining the decision on this proposed lease application. These include the following:

5.1. Regional Coal Team Consultation

The Hay Creek II LBA coal lease application included in this EIS was reviewed and discussed at PRRCT public meetings held on April 19, 2006, in Casper, Wyoming. The applicant presented information about the existing mine and pending lease application to the PRRCT at that meeting. Voting and nonvoting members of the PRRCT include the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, the USDA Forest Service, OSM, USFWS, National Park Service, and USGS. The PRRCT determined that the land in the Hay Creek II LBA application met the qualifications for processing as a production maintenance tract. The PRRCT recommended that the BLM continue to process the Hay Creek II LBA coal lease application.

5.2. Governor's Consultation

The BLM Wyoming State Director notified the Governor of Wyoming on September 18, 2006, that the Buckskin Mine had filed a lease application with the BLM for the Hay Creek II LBA tract.

5.3. Public Notice

The BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Scoping in the *Federal Register*, the Gillette *News-Record*, and a BLM news release on January 17, 2008. The publication served as public notice that the Hay Creek II LBA coal lease application had been received, announced the time and location of a public scoping meeting, and requested public comment on the Hay Creek II LBA application.

Parties on the distribution list were sent letters announcing the time and location of a public scoping meeting on January 31, 2008, in Gillette, Wyoming. At the public meeting, the applicant presented information about their mine and their need for the coal. The presentation was followed by a question and answer period, during which no oral comments were made. The scoping period extended from December 21, 2007, through March 29, 2008, during which time the BLM received written, e-mailed, and telephoned comments from interested individuals and entities.

The EPA will publish a Notice of Availability in the *Federal Register* for the draft EIS. The BLM will publish a Notice of Availability and Notice of Public Hearing in the *Federal Register* for the draft EIS, which will be followed by a 60-day comment period on the DEIS. A formal public hearing will be held

[1] Refer to page xiii for a list of abbreviations and acronyms used in this document.

during the 60-day comment period to solicit public comments on the DEIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of coal from the LBA tract.

Following the comment period on the draft EIS, the final EIS will be prepared. Comments received from the public, state, and federal review agencies on the draft EIS will be included in the final document. Parties on the distribution list will be sent copies of the final EIS when it is completed, and the EPA and BLM will publish a Notice of Availability when it is ready for release. After a 30-day availability period, the BLM will make a separate decision to hold or not to hold a competitive lease sale for the federal coal in the LBA tract and a ROD will be signed. Copies of the ROD will be sent to all parties on the mailing list and others who commented on this LBA during the NEPA process. A 30-day appeal period will be in place after the ROD is signed and before it is implemented.

5.4. Department of Justice Consultation

After the competitive coal lease sale, but prior to issuance of a lease, the BLM will solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 day period, the BLM can proceed with issuance of the lease.

5.5. Other Consultations

Other federal, state, and local governmental agencies that were consulted in preparation of this EIS are listed in Table 5-1.

Table 5-1. Federal, State, and Local Governmental Agencies Consulted in Preparation of the Environmental Impact Statement

Name	Project Responsibility
National Oceanic and Atmospheric Association	
Pieter Tans	Earth System Research Laboratory Global Monitoring Division Carbon Cycle and Greenhouse Gases Senior Scientist
University of Wyoming	
Bonnie Heidel	Wyoming Natural Diversity Database Botanist
Ron Hartman	Rocky Mountain Herbarium Curator
B. Ernie Nelson	Rocky Mountain Herbarium Manager
BLM National Science and Technology Center (Powder River Basin Coal Review)	
Craig Nicholls	Air Quality and Climate
Paul Summers	Water Resources

Name	Project Responsibility
ENSR International (Powder River Basin Coal Review)	
Valerie Randall	Project Manager
Dolora Koontz	Assistant Project Manager and Task 2 Manager (Existing Development and Reasonably Foreseeable Development)
Eldon Strid, Matt Reilly	Existing and Projected Coal Development and Coal Transportation Scenarios
Doree Dufresne	Database Development
Bruce MacDonald, PhD	Air Quality
Robert Berry, PhD	Water Resources
James Rumbaugh	Ground Water Modeling
Brad Anderson	Surface Water
Ron Dutton, George Blankenship	Socioeconomics
Bernhard Strom	Land Use, Transportation, and Utilities
William Berg	Topography, Geology, and Minerals
James Burrell, James Nyenhuis	Soils and Alluvial Valley Floors
Jon Alstad	Vegetation, Wetlands, and Grazing
Charles Johnson	Wildlife
Rollin Daggett	Fisheries
Kim Munson	Native American Concerns, and Paleontological Resources

5.6. List of Preparers

This draft EIS was prepared by ICF Jones & Stokes, a third-party contractor, under the direction of the BLM. Representatives from cooperating agencies reviewed and contributed to the EIS. Tables 5-2 and 5-3 provide listings of the BLM, OSM, and WDEQ interdisciplinary team and the third-party consultant personnel who prepared and reviewed this EIS.

Table 5-2. List of Contributors and Reviewers

Name	Project Responsibility
BLM Wyoming State Office	
Bob Janssen	Coal Program Coordination
Janet Kurman	NEPA Coordination
Mavis Love	Land Adjudication
Larry Jensen	Socioeconomics
Steve Hageman	Minerals Appraiser
Susan Caplan	Air Quality and Climate
John Zachariassen	Air Quality and Climate
Rick Schuler	Water Resources

Name	Project Responsibility
Julie Weaver	Land Adjudication
BLM Wyoming State Office Reservoir Management Group	
Dwain McGarry	CBNG Geology
Lee Almasy	CBNG Reservoir Engineering
Karl Osvald	CBNG Geology
BLM Buffalo Field Office	
Buck Damone	Cultural Resources
Leigh Grench	Cultural Resources
Clint Cargo	Cultural Resources
B.J. Earle	Cultural Resources
Patrick Cole	Wildlife
Don Brewer	Wildlife
Gerald Queen	Mining Claims
Office of Surface Mining Reclamation and Enforcement Western Regional Coordinating Center	
Foster Kirby	Acting NW Branch Manager
Heather Erickson	EIS Project Coordinator
Wyoming State Planning Office	
Steve Furtney	Coal Issues Coordination/Cooperating Agency Representative
Wyoming Department of Environmental Quality	
Dan Clark	Ombudsman
Land Quality Division	
Don McKenzie	Administrator
Kathy Muller Ogle	CHIA Program Supervisor
Doug Emme	Blasting Program Principal
Mark Rogaczewski	District Three Supervisor
Air Quality Division	
Kelly Bott	Engineer/EIS Cooperating Agency Division Representative
Paige Smith	Planning Section Manager
Water Quality Division	
John Wagmer	Water Resources
Wyoming Department of Transportation	
Larry Konetzki	DOT District Maintenance Engineer
Wyoming Game and Fish	
John Emmerich	Deputy Director – External Programs

Table 5-3. List of Preparers

Name	Education/Experience	Responsibility
BLM CASPER FIELD OFFICE		
Teresa Johnson	M.S. course work in Ecosystem Management, B.S. Earth Systems Ecology, Native American Cultural Emphasis Phase, 2 years professional NEPA experience	BLM Project Manager-EPS
Mike Karbs	M.S., B.S. Mineral Engineer, Public Policy, 33 years professional experience	Assistant Field Manager – Solid Minerals
Sarah Bucklin	M.S. Zoology, B.S. Biology, Registered Associate Wildlife Biologist, 9 years professional experience	Environmental Protection Specialist
Ginger Vickers	B.A. Resource Management, 2 years of professional experience	Public Involvement – Legal Assistant
ICF JONES & STOKES (THIRD-PARTY CONTRACTOR)		
Gwyn McKee	M.S. Wildlife Management/Ecology, B.S. Wildlife Management, 20 years professional experience	Project Manager/Wildlife Survey, T&E Wildlife Survey/Report Preparation/Document Review
Kim Stevens	B.S. Geography, 7 years professional experience	Project Coordinator/Report Preparation
Bryan Morse	B.S. Urban Planning, 4 years professional experience	Project Assistant/Report Preparation
Jim Wilder	M.S. Environmental Engineering, B.S. Civil Engineering, 31 years professional experience	Noise Assessment/Report Preparation
Rose Difley	M.S., B.S. Geology, 5 years professional experience	Paleontology Survey/Report Preparation
Deborah Bartley	B.A. Political Science, U.D. International Relations, 10 years professional experience	Lead Editor
Brent Bouldin	M.A. Communications, B.S. Communications, 31 years professional experience	Technical Editor/Document Production
Kate Walsh	B.A. History, B.A. Photography, 8 years professional experience	Document Production
Bobby Tuttle	M.S. Biology, B.S. Planning, 17 years professional experience	Wetlands Survey/Project Director
SUBCONTRACTORS FOR ICF JONES & STOKES		
Ron Dutton Sammons/Dutton LLC		Socioeconomic Evaluation
Brenda Schladweiler Jamie Eberly BKS Environmental Associates, Inc.		Soil Survey/Report Preparation
Gregory S. Newberry Antiquus Cultural Resource Consulting		Cultural Resource Survey/Report Preparation
SUBCONTRACTORS FOR BUCKSKIN MINE		
Julie Gerlach Robert Tilden Aqua Terra Consultants, Inc.		Land Use Assessment, Water Resources Analysis, Geology and Minerals Evaluation, Alluvial Valley Floor Assessment/Report Preparation
Richard Bonine, Jr. LandTrak Resources		Vegetation Survey, T&E Vegetation Survey /Report Preparation
Ronn Smith Inter-mountain Laboratories, Inc.		Air Quality Assessment/Report Preparation

5.7. Distribution List

This draft EIS was distributed to Congressional offices, federal agencies, state governments, local governments, industry representatives, interest groups, and individuals for their review and comment (Table 5-4).

Table 5-4. General BLM Information Distribution List for Coal Leasing

FEDERAL AND STATE OFFICIALS	
Congresswoman Cynthia M. Lummis	Representative Timothy Hallinan
Governor of Montana - Honorable Brian Schweitzer	Senator Jim Anderson
Governor of Wyoming - Honorable Dave Freudenthal	Senator John Hines
Representative Dave Edwards	Senator Michael Von Flatern
Representative Erin Mercer	US Senator John Barrasso
Representative Sue Wallis	US Senator Mike Enzi
Representative Thomas Lubnau	
FEDERAL AGENCIES	
BLM - Cheyenne, Wyoming	OEPC - Denver, CO
BLM - Billings, MT	OSM - Casper, WY
BLM - Buffalo, WY	OSM - Denver, CO
BLM - Casper, WY	OSM - Washington, DC
BLM - Miles City, MT	OSM Library - Denver, CO
BLM - Washington, DC	Rocky Mountain Region Solicitor
BLM Library - Denver, CO	US Army Corps of Engineers
Bureau of Indian Affairs	US EPA - Washington, DC
National Park Service - Washington, DC	US EPA Region VIII - Denver, CO
Department of Natural Resources & Conservation - Helena, MT	US Fish & Wildlife Service - Arlington, VA
Department of Energy - Casper, WY	US Fish & Wildlife Service - Cheyenne, WY
Department of Energy – Washington DC	US Geological Survey – Cheyenne, WY
Department of the Interior - Denver, CO	US Geological Survey - Denver, CO
DOI Natural Resource Library - Washington, DC	US Geological Survey - Reston, VA
MMS - Denver, CO	US Government Printing Office
MMS - Helena, MT	USDA Forest Service - Golden, CO
MMS – Herndon, VA	USDA Forest Service - Douglas Ranger District
MMS Solid Min/Geothermal CAM – Denver, CO	USGS Water Resources Division - Cheyenne, WY
National Park Service - Denver, CO	

State Agencies	
State of Wyoming, Department of Transportation	Wyoming Game & Fish Department - Lander, WY
State of Wyoming, Office of State Lands & Investments	Wyoming Game & Fish Department - Sheridan, WY
State of Wyoming, Office of the State Treasurer	Wyoming Oil and Gas Conservation Commission
WDEQ - Air Quality Division - Cheyenne, WY	Wyoming Parks and Cultural Resources Department
WDEQ - Land Quality Division - Sheridan, WY	Wyoming Public Service Commission
WDEQ - Water Quality Division - Cheyenne, WY	Wyoming State Engineer's Office
WDEQ Land Quality Division - Cheyenne, WY	Wyoming State Geological Survey
Wyoming Department of Agriculture	Wyoming State Historic Preservation Office
Wyoming Department of Education	Wyoming State Planning Office
Wyoming Department of Employment, Research & Planning	Wyoming Department of Transportation
Wyoming DEQ/ISD	Wyoming Water Development Commission
Wyoming Game & Fish Department - Cheyenne, WY	
Local Government Agencies	
Big Horn County Commission	Converse County School District
Campbell County	Converse County, Special Projects
Campbell County Board of Commissioners	Devils Tower National Monument
Campbell County Conservation District	Gillette Department of Community Development
Campbell County School District	Medicine Bow National Forest
City of Douglas	Rosebud County Commission
City of Gillette	Town or Wright
Converse County Commission	Weston County Board of Commissioners
Converse County Joint Powers Board	
Tribal Organizations and Individuals	
Apache Tribe of Oklahoma	Kiowa Business Committee
Apache Tribe of Oklahoma Tribal Chairman	Kiowa Business Committee
Arapahoe Business Council	Lower Brule Sioux Tribal Council
Arapahoe Business Council	Lower Brule Sioux Tribe
Cheyenne River Sioux Tribe	Northern Arapaho Business Council
Cheyenne River Sioux Tribe THPO	Northern Arapaho Tribe
Cheyenne-Arapaho Tribes of Oklahoma	Northern Cheyenne Cultural Commission
Comanche Nation	Northern Cheyenne Tribe
Comanche Nation Tribal Chairman	Oglala Sioux Tribe
Comanche Tribe NAGPRA Office	Oglala Sioux Tribe THPO

Crow Creek Sioux Tribe THPO	Rosebud Sioux THPO
Crow Creek Sioux Tribe, South Dakota	Rosebud Sioux Tribal Council
Crow Tribe, Montana	Rosebud Sioux Tribe
Eastern Shoshone Tribe	Santee Sioux Tribe
Flandreau Santee Sioux Tribe	Shoshone Business Council
Flandreau Santee Sioux Tribe Office of Cultural Preservation	Standing Rock Sioux Tribe
Kiowa Business Committee Environmental Director	Standing Rock Sioux Tribe THPO
ORGANIZATIONS	
Advisory Council on Historic Preservation	Theodore Rososevelt Conservation Partnership
Biodiversity Conservation Alliance	Thunder Basin Coalition
Campbell County Economic Development Corp.	Trout Unlimited
Center for Biological Diversity	Wyoming Association of Professional Archeologists
Defenders of Wildlife	Wyoming Bankers Association
Foundation for North American Wild Sheep	Wyoming Business Alliance
National Resource Defense Council	Wyoming Business Council/NE Region
National Wildlife Federation	Wyoming Mining Association
NWU Policy Research Institutes	Wyoming Outdoor Council
NWU Policy Research Inst.	Wyoming Public Service Commission
Petroleum Association of Wyoming	Wyoming Stock Growers Association
Powder River Basin Resource Council	Wyoming Wildlife Federation
Sierra Club	Wyoming Wool Growers Association
COMPANIES/BUSINESSES	
American Colloid Company	Kiewit Mining Group, Inc.
All American Equipment	Kiewit Mining Properties, Inc.
Antelope Coal, LLC	Kiewit Mining Properties Inc., Gillette
Ark Land Company	Kiewit Mining Properties Inc., Omaha
Belle Fourche Pipeline Company	LE Peabody & Associates
Bill Barrett Corporation	M & K Oil company Inc.
Bitter Creek Pipelines, LLC	Majestic Petroleum Operations, LLC
Bjork Lindley Little PC	Marston & Marston
BKS Environmental Associates, Inc.	McGraw-Hill
Blackstone Energy Inc.	McVehil-Monnett Associates Inc.
BNSF Railway Company	Meineadair Consultants
Bridgeview Coal Co.	National Mining Association

Buckskin Mining Company	NM Doelger Consulting, LLC
Burns & McDonnell	Norwest Corporation
CANDO	NRCS
Carbon Recovery Technology	P & M Coal
CH Snyder Company	P & M Coal Mining Co
CONSOL Inc Expl & Land Dept.	Peabody Energy
Cordero Rojo Mine	Powder River Coal, LLC
Cucker, Montgomery, Aronstein & Bess, PC	Powder River Energy Corporation
Devon Energy Prod Co. LP	Preston Reynolds & Co., Inc., Denver
Devon Energy Production Co. LP	QWEST Corporation (PKA)
Dry Fork Coal Company	Redstone Resources Inc.
Ducker Montgomery et al.	Resolute Wyoming
Economic Analysis Division	Rio Tinto Energy America
EDE Consultants	Riverside Technology Inc.
ENSR	Storm Can Energy, LLC
Environmental Solutions Inc., Beulah, WY	Storm Cat eng (Power RVR)LLC
Environmental Solutions Inc., Sedalia, CO	Tetra Tech EC, Inc.
EOG Resources Inc.	Thunder Basin Coal Company
Foundation Coal West Inc. PKA	Thunderbird-Jones & Stokes
Foundation Coal West, Inc.	TRC Environmental
Great Points Energy	Union Pacific Railroad
Harden & Associates	US West Communications
HQ-USAF/CEVP	Western Energy Company
Intermountain Resources	Western Fuels Association
Interwest Mining Company	Woodward Enterprises LLC
Jacobs Ranch Coal Company	WWC Engineering
JIREH Exploration and Consulting LLC	Yates Petroleum Corporation
Kenneth R Paulsen Consultants	Mining Associates of Wyoming
Kiewit Mining Company	
PRESS	
Associated Press	Gillette News-Record
Casper Star Tribune	Platts
Douglas Budget	Wyoming - Tribune Eagle

Educational Intuitions	
CSU Library	University of Wyoming Libraries
Northwestern University	URS Greiner Woodward Clyde Library
Individuals	
Barbero, Ralph	McGee, Carl
Belden, Scott	McGee, John
Benson, Scott	McGee, Keith
Bierman, Sheldon	McGee, Russell
Brown, Geraldine	Miller, Faustine
Brown, Maurice	Nichols, Jeremy
Bullock, Van	Nyenhuis, Jim
Carter, Wilma	Oedekoven, Byron & Marjorie
Chase, Dorothy	Persson, Irene
Chase, Russel	Phoenix (aka Phoenix), Donna Jean
Chase, William	Saulcy, Bill
Collins, Kristina	Semple, William
Couch, Marion	Turner Dr. Jenny
Couch, Tom	Turner Dr., Wendy
Craft, Lecia	Turner, Dan
Glustrom, Leslie	Turner, LJ
Greub, Twyla	Turner, Mike
Heisner, Bill	Ukeiley, Robert
Kass Dr., Thomas	Wanke (pka Vincent), Jeanie
Long, Robert	Ward, Linda
Maurice, Brown W.	Williams, John
McAfee, Paul	Williams, Keith
McCormick, Betty Jo and John J.	Williams, Monica
McGee Harlow, Helen Marie	Winland, Mark
Trusts	
Avis Harrod Trust	Frank Ford, Trustee
Cecle L & Laverne L. Cook Trust	Joe W. King Rev. Trust

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7.0 GLOSSARY

aboriginal – Related to early or primitive cultures in a region. Being the first or earliest known of its kind in a specific region.

ad valorem tax – A tax paid as a percentage of the assessed value of property.

adverse impact – An apparent direct or indirect detrimental effect.

air stagnation event – When air is trapped by poor ventilation due to persistent light or calm winds, and by the presence of inversions.

aliquot – An exact portion.

alkalinity – The degree to which the pH of a substance is greater than 7 (on a scale of 1 to 14).

alluvial deposit – Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water, such as streams, and deposited at points of weak water flow; alluvium.

alluvial valley floor (AVF) – An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities (see 30 CFR 701.5).

alluvium – Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its flood plain or delta.

alternative – In terms of the National Environmental Policy Act, one of several substitute or alternate proposals that a federal agency is considering in an environmental analysis.

ambient – Surrounding conditions (or environment) in a given place and time.

annual precipitation – The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.

approximate original contour – Postmining surface configuration achieved by backfilling and grading of mined-out areas so that the reclaimed land surface resembles the general surface configuration of the land prior to mining (see 30 CFR 701.5).

aquatic – Living or growing in or on the water.

aquifer – A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use.

aquitard – A confining bed that retards but does not totally prevent the flow of water to or from an adjacent aquifer; a leaky confining bed.

area source – A plant site that does not emit any single HAP (Hazardous Air Pollutant) at a rate of 10 tons or greater per year, or any combination of HAPs at a rate of 25 tons or greater per year.

arithmetic mean – The sum of the values of n numbers divided by n. It is usually referred to as simply the "mean" or "average".

ash – The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the quality of the coal.

avian – Of, relating to, or derived from birds.

backfill – The operation of refilling an excavation. Also, the material placed in an excavation when it is refilled.

baseline – Conditions, including trends, existing in the human environment before a proposed action is begun; a benchmark state from which the environmental consequences of an action are forecast; the no-action alternative.

beneficial impact – An apparent direct or indirect advantageous effect.

bentonite – A clay formed by the decomposition of volcanic ash which has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.

bonus – That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals [see 43 CFR 3400.0-5(c)].

braided stream – A stream flowing in several dividing and reuniting channels resembling the strands of a braid.

buffer zone – An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.

bypass coal – An isolated part of a coal deposit that is not leased and that can only be economically mined in an environmentally sound manner as a part of continued mining by an existing adjacent operation [see 43 CFR 3400.0.5(d)].

clinker (scoria) – Baked and fused rock resulting from in-place burning of coal deposits.

coal bed natural gas (CBNG) – Natural gas (methane) that is generated during the coal-forming process.

coal combustion products (CCPs) – the materials produced primarily from the combustion of coal in coal-fired power plants.

colluvium – Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.

confluence – The point at which two or more streams meet.

conglomerate – A rock that contains rounded rock fragments or pebbles cemented together by another mineral substance.

contiguous – Lands or legal subdivisions having a common boundary point.

cooperating agency – An agency which has jurisdiction by law in an action being analyzed in an environmental document and who is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document [see 40 CFR 1501.6 and 1508.5].

crucial wildlife habitat – Parts of the habitat necessary to sustain a wildlife population during periods of their life cycle. It may be a limiting factor on the population, such as nesting habitat or winter habitat.

cultural resources – The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred, and (3) the environment immediately surrounding the resource.

cumulative impact – The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

decertification process – During the 1970s and early 1980s, the PRB emerged as a major coal production region, and coal leasing in the PRB operated as a certified federal coal production region during that period. Under this process, coal leases were sold in parcels of sufficient size to open a new mine or make significant contributions to expanding existing mine operations, as described under 43 CFR 3420. Leasing was developed through this regional process through the 1980s.

In 1982, the BLM temporarily halted coal leasing in the PRB. However, the existing mines continued producing coal, which depleted their leased federal coal reserves. As a result, interest in leasing federal coal to extend mining operations at existing mines in the PRB increased in the late 1980s, but little to no interest in a regional sale to obtain sufficient reserves to open new mines was expressed during that period. The PRB had reached a point where sufficient mining operations had been established to meet expected coal demand.

This "maintenance" lease approach by the operators resulted in an insufficient interest in coal leasing to justify a continued regional leasing approach. In 1990, based on the advice of the Powder River Regional Coal Team (PRRCT), the BLM decertified the region for coal leasing. That decertification process allowed the BLM to begin processing applications by existing mines to lease smaller, individual maintenance tracts of federal coal using the lease by application (LBA) process under the rules of 43 CFR 3425. Many of the federal coal production regions were decertified in the later 1980s, in large part because of a decline of interest in leasing federal coal throughout the country.

decibel – A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.

deciview (dv) – A general measure of view impairment (13 deciview equals a view of approximately 60 miles) caused by pollution. A 10 percent change in extinction corresponds to 1.0 dv.

Desorb/desorption – A phenomenon whereby a substance is released from or through a surface.

dip – The angle at which a rock layer is inclined from the horizontal.

direct (or primary) impact – An impact caused by an action that occurs at the same time and place as the action (see 40 CFR 1508.8).

discharge – Any of the ways that ground water comes out of the surface, including through springs, creeks, or being pumped from a well.

dissected upland – An upland or high area in which a large part of the original surface has been deeply cut into by streams.

Dragline – A type of excavating crane that consists of a large bucket and cable ropes suspended out over a long boom arm. The bucket of this apparatus collects the targeted material by pulling the bucket toward itself on the ground with a second rope or cable, elevates the bucket, and dumpsthe material either on a backfill bank, pile or various mode of transport such as a transport truck. A dragline operation is typically used to remove over burden above coal or for tar-sand mining.

drawdown – The reduction in groundwater quantity in the aquifers as a result of seepage into and dewatering from mine excavations.

eolian/aeolian deposit – Sand and other loose materials carried, formed, or deposited by the wind.

ephemeral stream – A stream or portion thereof that flows occasionally because of surface runoff, and is influence nominally by natural springs and is not influenced by continuous permanent ground water flow from snow melt or other sources.

erosion – The wearing away of the land surface by running water, wind, ice or other geologic agents.

evapotranspiration – The sum total of water lost from the land by evaporation and plant transpiration.

excavation (archeological) – The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.

fair market value – The amount in cash, or terms reasonably equivalent to cash, for which a coal deposit would be sold or leased by a willing seller to a willing buyer.

fixed carbon – In coal, the solid combustible material remaining after removal of moisture, ash, and volatile matter. It is expressed as a percentage.

floodplain – The relatively flat area or lowland adjoining a body of flowing water, such as a river or stream, that is covered with water when the river or stream overflows its banks.

forage – Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.

formation (geologic) – A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.

fossil – The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin that are not considered to be fossils (e.g. oil, gas, asphalt, limestone).

fugitive dust – Small particles that become airborne as a result of natural factors (i.e., wind blowing across unvegetated areas) or in response to surface disturbance (e.g., vehichles, wildlife and livestock movements).

geometric mean – The nth root of the product of the values of n positive numbers.

ground water – Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

habitat – A place where a plant or animal naturally or normally lives and grows.

habituation – The process of becoming accustomed to, or used to, something; acclimation similar to acclimation.

hazardous materials – Substance which, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons, damage to property or the environment.

hazardous waste – Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR § 261.

heterogenous – Made up of dissimilar constituents.

human environment – The natural and physical environment and the relationship of people with that environment (see 30 CFR 1508.14).

hydraulic conductivity – The capacity of a medium to transmit water when a hydraulic gradient is present; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.

hydraulic – Pertaining to fluid in motion, or to movement or action caused by water.

hydric soil – A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

hydrocarbon – Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.

hydrogeology – The science that deals with movement and disturbance of any groundwater along with its interaction with the soil and rocks of the earth's crust.

hydrology – The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.

hydrophytic vegetation – The plant life growing in water or on an area of soil that is frequently inundated or saturated with moisture (aka water). This area periodically is deficient in oxygen as a result of the excessive moisture content of the soil. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland characteristics.

impermeable – Not capable of transmitting fluids or gasses in appreciable quantities.

incised – Having a margin that is deeply and sharply notched/cut.

indirect (or secondary) impact – A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (see 40 CFR 1508.8).

in-place coal reserves – The estimated volume of all of the coal reserves in a lease without considering economic or technological factors that might restrict mining.

in-situ leach mining – Removal of the valuable components of a mineral deposit through chemical leaching without physical extraction of the rock.

interbedded – Layers of one type of rock, typically thin, that are laid between or that alternate with layers of another type of rock.

interburden – A layer of sedimentary rock that separates two mineable coal beds.

interdisciplinary – Characterized by participation or cooperation among two or more disciplines or fields of study.

intermittent stream – A stream that does not flow year-round but has some association with ground water for surface or subsurface flow.

laminated – Consolidated or unconsolidated sediment that is characterized by thin (less than 1 centimeter thick) layers.

land and resource management plan (LRMP) – A land use plan that directs the use and allocation of U.S. Forest Service lands and resources.

lead agency – The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (see 40 CFR 1508.16).

lease (mineral) – A legal document executed between a mineral owner or lessor and another party or lessee which grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained [see 43 CFR 3400.0-5(r)].

lek – A traditional breeding area in or adjacent to sagebrush dominated habitat where five or more males engage in competitive mating displays of strutting to obtain a mate for the purpose of breeding.

lek complex – A grouping of individual leks that are in close proximity to each other that the male sage-grouse may move between on a daily basis. At the present time a criteria to determine the distance between leks within a lek complex does not exist.

lek count – A lek count is a way of documenting the actual number of breeding male-grouse within a particular lek or lek complex. The criteria to conduct a lek count are available from the WGFD.

lek survey – Lek surveys are conducted when a lek count is infeasible to complete do to location or weather deterrents. Lek surveys are not nearly as thorough as lek counts and can be done via a plane or helicopter when time, weather and or terrain prohibits a comprehensive lek count. Lek surveys do not take exact count of the number of grouse within a lek but are meant as an overall snapshot of a lek or lek complex to determine if a lek is active or inactive as well as to monitor the population and to see if a lek count is needed. This survey can require as little as one visit to a suspected lek. Lek surveys are conducted from early March to early to mid May based on terrain and weather.

lek annual status – Lek annual status is determined by the following:

- **Active** – Any lek where there have been male grouse seen strutting or there are recent signs of strutting by male sage-grouse during the mating season.
- **Inactive** – There are insufficient indicators of a site being used by grouse during the strutting season. A minimum of 2 surveys separated by 7 days need to be completed in optimum strutting conditions. The results of the survey must be devoid of any evidence of strutting in other words no birds, droppings, feathers or scratch marks can be present. The survey to determine that a lek is inactive cannot be completed aerially.
- **Unknown** – Where the status of a lek has not been determined/documented during a strutting season as active or inactive.
- **management status** – The management status is determined based on what the annual status is determined to be, once the management status is determined a lek is placed in one of the following categories for management.

- **Occupied lek** – As stated by the Wyoming DEQ and FWS an occupied lek is "a lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities".
- **Unoccupied lek**- An unoccupied lek falls under one of the following and are not protected during any surface disturbing activities.
  - **Destroyed lek** – A destroyed lek is an area that had once been an active lek site including appropriate habitat that is no longer suitable for sage-grouse breeding. A destroyed lek area is not monitored unless the site has been reclaimed and the habitat is considered once again considered suitable for sage-grouse mating.
  - **Abandoned lek** –An area of habitat that would be considered appropriate habitat for breeding but has not see any measurable activity for a period of 10 consecutive years. During the 10 consecutive years a lek has to be considered "inactive" for a minimum of four non- consecutive strutting seasons. The area in which a lek is labeled as abandoned must be surveyed a minimum of once every ten years to maintain the abandoned lek status and to ensure that no new grouse activity has begun.
  - **Undetermined lek** – An undetermined lek is a lek in which there is insufficient data over the preceding 10 years to determine its actual status as either unoccupied or active. An undetermined lek will be protected as if it is active during all surface disturbance activity or until such time enough data has been compiled to determine its status as inactive.

lenticular – Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.

limb (geologic) – One of the two parts of a fold (syncline or anticline) on either side of an axis.

limestone – A sedimentary rock consisting chiefly of calcium carbonate (CaCO3).

lineament – A linear topographic feature of regional extent that is believed to reflect the hidden architecture of the rock structure below the surface.

loadout facilities – The mine facilities used to load the mined coal for transport out of the mine.

loam – A rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

maintenance tract – A federal coal tract that would continue or extend the life of an existing coal mine.

major federal action – An action with effects that may be major and which is potentially subject to federal control and responsibility (see 40 CFR 1508.18).

major sources – Those sources that emit more than 10 tons per year of any single hazardous air pollutant, or 25 tons of all hazardous air pollutants combined. The determination of major is based on all sources of hazardous air pollutants at the site, and not just the equipment affected by the MACT standard.

maximum economic recovery (MER) – The requirement that, based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations [see 43 CFR 3480.0-5(a)(24)].

meteorological – Related to the science dealing with the atmosphere and its phenomena, especially as relating to weather.

methane – A colorless, odorless, and inflammable gas; the simplest hydrocarbon; chemical formula = CH_4. It is the principal constituent of natural gas and is also found associated with crude oil and coal.

mineable coal – Coal that can be economically mined using present day mining technology.

mineral rights – The rights of one who owns the mineral estate (subsurface).

mining permit – A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (see 30 CFR 701.5).

mitigation – An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

mudstone – A hardened sedimentary rock consisting of clay, silt, siltstone, claystone, shale and argillite. It is similar to shale but lacks distinct layers. This term is also used when there is doubt as to the precise identification of a deposit.

National Register of Historic Places – A list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a)(1) (A) of the National Historic Preservation Act.

natural gas – Combustible gases (such as hydrocarbons) or mixtures of combustible gases and non-combustible gases (such as helium) that are in a gaseous phase at atmospheric conditions of temperature and pressure.

NEPA process – All measures necessary for compliance with the National Environmental Policy Act of 1969 (see 40 CFR 1508.21).

No Action Alternative – An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives.

operationally limited – Lands around or between those features that are inaccessible for mining within a lease area.

outcrop – A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.

overburden – Material of any nature, consolidated or unconsolidated, that overlies a coal or other useful mineral deposit, excluding topsoil.

paleontological resource – A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.

peak discharge or flow – The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows.

perennial species (vegetation) – Vegetation that lives over from season to season.

perennial stream – A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.

permeability – The ability of rock or soil to transmit a fluid.

permit application package – A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the Mineral Leasing Act and its implementing regulations.

permit area – The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR Part 800 and which shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (see 30 CFR 701.5).

physiography – Physical geography the systematic classification and description of natural physical features.

piezometer – A well, generally of small diameter, that is used to measure the elevation of the water table.

playa – The sandy, salty, or mud-caked flat floor of a basin with interior drainage, usually occupied by a shallow ephemeral lake during or after rain or snow storms.

point source (pollution) – A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

pore volume – The amount of fluid necessary to fill the void space in an unsaturated porus medium (i.e., mine backfill).

porosity – The percentage of the bulk volume of rock, sediment or soil that is not occupied by sediment or soil particles; the void space in rock or sediment. It may be isolated or connected.

postmining topography – The relief and contour of the land that remains after mining has been completed.

potentiometric surface – The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full hydraulic head.

prime or unique farmland – Those lands which are defined by the Secretary of Agriculture in 7 CFR part 657 (*Federal Register* Vol. 4 No. 21) and which have historically been used for cropland (see 30 CFR 701.5).

proposed action – In terms of National Environmental Policy Act, the project, activity, or action that a federal agency proposes to implement or undertake and which is the subject of an environmental analysis.

qualified surface owner – The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

1) Hold legal or equitable title to the surface of split estate lands;
2) Have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or received directly a significant portion of their income, if any, from such farming and ranching operations; and
3) have met the conditions of (1) and (2) above for a period of at least three years, except for persons who gave written consent less than three years after they met the requirements of both (1) and (2) above [see 43 CFR 3400.0-5(gg)].

raptor – Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.

recharge – The processes by which groundwater is absorbed into a zone of saturation.

reclamation – Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation and other work necessary to restore the disturbed area for postmining use.

record of decision (ROD) – A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).

recoverable coal – The amount of coal that can actually be recovered for sale from the demonstrated coal reserve base.

recreational river areas – Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

rental payment – Annual payment from a lessee to a lessor to maintain the lessee's mineral lease rights.

resource management plan (RMP) – A land use plan, as prescribed by FLPMA, that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an environmental impact statement (EIS) to determine which plan will best direct the management of the public lands and resources.

revegetation – The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.

right-of-way – The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.

riparian – The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.

royalty (mineral) – A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.

runoff – That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.

salinity – Refers to the solids, such as sodium chloride (table salt) and alkali metals, that are dissolved in water. Often in non-saltwater areas, total dissolved solids is used as an equivalent term.

sandstone – A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.

scoping – A public informational process required by the National Environmental Policy Act to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an environmental impact analysis.

scoria (clinker) – Baked and fused rock resulting from in-place burning of coal deposits.

sedimentation pond – An impoundment used to remove solids from water in order to meet water quality standards or effluent limitations before the water leaves the permit area (see 30 CFR 701.5).

selenosis – Selenium poisoning; chronic (long-term) exposure to high levels of selenium in food and water.

semi-arid – A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.

severance tax – A tax imposed by the government on the extraction of minerals and other natural resources from the ground.

shale – A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles that is laminated; lithified, layered mud.

significant impact – A qualitative term used to describe the anticipated importance of impacts to the human environment as a result of an action.

siltstone – A fine-grained clastic rock consisting predominately of silt-sized particles.

slope wash – A general term to refer to colluvium found along the bottom slopes of hills and in channel bottoms as a result of soil erosion and the down-slope movement of sediment; reworked sediment deposited by flow over the ground surface (e.g., runoff).

socioeconomics – The social and economic situation that might be affected by a proposed action.

soil survey – The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.

spontaneous combustion – The heating and slow combustion of coal and coaly material initiated by the absorption of oxygen.

stipulations – Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.

storage coefficient – The volume of water that can be released from storage per unit surface area of a saturated confined aquifer, per unit decline in the component of hydraulic head normal to the surface. It is calculated by taking the product of the specific storage and the aquifer thickness.

stratigraphic – Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth's crust.

stream-laid deposits – A loose mix of sand, gravel, and silt deposited by stream flow within a stream channel.

stripping ratio – The unit amount of overburden that must be removed to gain access to a similar unit amount of coal.

subirrigation – In alluvial valley floors, the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation (see 30 CFR 701.5).

subbituminous – A lower rank of coal (35-45 percent carbon) with a heating value between that of bituminous and lignite, usually 8,300-11,500 Btu per pound. Subbituminous coal contains a high percentage of volatile matter and moisture.

surface disturbance – Any disturbance by mechanical actions that alters the soil surface.

surface rights – Rights to the surface of the land, does not include rights to oil, gas, or other subsurface minerals or subsurface rights.

suspended solids – The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

tectonic fracture – Fractures caused by deformation of the earth's crust.

threatened and endangered species – These species of plants or animals classified as threatened or endangered pursuant to Section 4 of the Endangered Species Act. Any species which is in danger of extinction, or is likely to become so within the foreseeable future.

- Category 1 – Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.
- Category 2 – Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (U.S. Fish and Wildlife Service).

topography – Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and manmade features.

topsoil – The surface layer of a soil, generally the top two to six inches and generally having more organic material and nutrients.

total dissolved solids (TDS) – The total quantity in milligrams per liter of dissolved materials in water.

transmissivity – The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Equals the hydraulic conductivity multiplied by the aquifer thickness. Values are given in units of gallons per day per foot.

transpiration – The discharge of water vapor by plants.

truck & shovel – A mining method used to remove overburden and coal in a strip mining operation. Truck and shovel operations use large bucket-equipped digging and loading machines (shovels) and large dump trucks to remove overburden instead of using a dragline for overburden removal.

typic – Typical.

unconfined aquifer – An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.

unsuitability criteria – The 20 criteria described in 43 CFR 3461, the application of which results in an assessment of federal coal lands as suitable or unsuitable for surface coal mining.

uranium – A very hard, heavy, metallic element that is crucial to development of atomic energy.

vegetation type – A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.

vertebrate fossils – The remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.

vesicular – Rock containing many small cavities that were formed by the expansion of a bubble of gas or steam during the solidification of the rock.

visual resources – The physical features of a landscape that can be seen (e.g., land, water, vegetation, structures, and other features).

Visual Resource Management (VRM) – The systematic means to identify visual values, establish objectives which provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

volatile matter – In coal, those substances, other than moisture, that are given off as gas or vapor during combustion.

waterfowl – A bird that frequents water, especially a swimming bird.

wetlands – Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs [see 33 CFR 328.3(a)(7)(b)].

wild and scenic river – Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories:

- **wild river areas** – Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- **scenic river areas** – Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

wilderness – An area of undeveloped Federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or primitive and unconfined recreation, (3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and (4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.

winter concentration area – Areas of winter habitat consistently used by sage-grouse. The determination of a winter concentration area is based on repeated observations of an area including the number of sage-grouse (typically 25 or more) and the quantity/quality of winter habitat characteristic. Coordination with the WGFD is necessary prior to any area being listed as a winter concentration area.

winter habitat – Areas where the sagebrush consistently provides forage (leaves and buds) for sage-grouse under any winter conditions. Sagebrush stands in this habitat are either tall enough (at least 10 to 14 inches) to maintain some branches above snow level, or they are located in windblown areas that are not regularly buried or drifted over by snow.

8.0 INDEX OF KEY WORDS

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APPENDIX A

FEDERAL AND STATE AGENCIES AND PERMITTING REQUIREMENTS

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APPENDIX A: FEDERAL AND STATE AGENCIES AND PERMITTING REQUIREMENTS

Agency	Lease/Permit Action[1]
FEDERAL	
Bureau of Land Management	▪ Coal Lease ▪ Resource Recovery & Protection Plan ▪ Scoria Sales Contract ▪ Exploration Drilling Permit
Office of Surface Mining Reclamation and Enforcement	▪ Preparation of MLA Mining Plan Approval Document SMCRA Oversight
Office of the Secretary of the Interior	▪ Approval of MLA Mining Plan
Mine Safety and Health Administration	▪ Safety Permit and Legal ID ▪ Ground Control Plan ▪ Major Impoundments
Bureau of Alcohol, Tobacco, and Firearms	▪ Explosive's Manufacturer's License ▪ Explosives Use and Storage Permit
Federal Communication Commission	▪ Radio Permit: Ambulance ▪ Mobile Relay System Radio License
Nuclear Regulatory Commission	▪ Radioactive By-Products Material License ▪ Radioactive Material Certificate of Registration
Army Corps of Engineers	▪ Authorization of Impacts to Wetlands and Other Waters of the U.S.
Department of Transportation	▪ Hazardous Waste Shipment Notification
Federal Aviation Administration	▪ Radio Tower Facilities Construction Permits
STATE	
Land Commission	▪ Coal Lease ▪ Scoria Lease
Department of Environmental Quality-Land Quality Division	▪ Permit and License to Mine ▪ Permit to Construct Sedimentation Pond
Department of Environmental Quality-Air Quality Division	▪ Air Quality Permit to Operate ▪ Air Quality Permit to Construct
Department of Environmental Quality-Water Quality Division	▪ Wyoming Pollutant Discharge Elimination System Water Discharge Permits ▪ Authorization to Construct Septic Tank & Leach Field ▪ Authorization to Construct and Install a Public Water Supply and Sewage Treatment System
Department of Environmental Quality-Solid Waste Management Program	▪ Solid Waste Disposal Permit-Permanent and Construction
Engineer's Office	▪ Appropriation of Surface Water Permits ▪ Appropriation of Ground Water Permits
Industrial Siting Council	▪ Industrial Siting Certificate of Non-Jurisdiction

MLA = Mineral Leasing Act of 1920; SMCRA = Surface Mining Control and Reclamation Act of 1977

[1] All individual lease/permit actions may not be required at all mines.

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APPENDIX B

UNSUITABILITY CRITERIA

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APPENDIX B: UNSUITABILITY CRITERIA

Unsuitability Criteria	General Recommendations for Buffalo Resources Area[1]	Findings for General Analysis Area
1. **Federal Land Systems.** With certain exceptions that do not apply to this tract, all federal lands included in the following systems are unsuitable for mining: National Parks, National Wildlife Refuges, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers, National Recreation Areas, Lands acquired through the Land and Water Conservation Fund, National Forests and Federal lands in incorporated cities, towns and villages.	Portions of federal lands located around Gillette, Sheridan, and Wright were determined to be unsuitable under this criterion.	None of the federal lands determined to be unsuitable under Criterion 1 are present in the general analysis area. Therefore, no unsuitable findings under Criterion 1 apply to the general analysis area.
2. **Rights-Of-Way and Easements.** Federal lands that are within ROWs or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally owned surface, are unsuitable for mining.	Portions of the BNSF and UP railroad ROWs, the Tri-County 230-kV transmission line ROW, the Wyoming 450 ROW, and the I-90 ROW were found to be unsuitable under this criterion within the general review area.	The portions of the Tri-County 230-kV transmission line ROW, the Wyoming 450 ROW, the I-90 ROW, and the BNSF and UP railroad ROWs that were determined to be unsuitable are not located within the general analysis area. Therefore, no unsuitable findings under Criterion 2 apply to the general analysis area.
3. **Buffer Zones for Rights-Of-Way, Communities, and Buildings.** Federal lands within 100 feet of a ROW of a public road or a cemetery; or within 300 feet of any public building, school, church, community or institutional building, or public park; or within 300 feet of an occupied dwelling are unsuitable for mining.	Portions of Wyoming 450, I-90, and one cemetery were found to be unsuitable under this criterion. Decisions were deferred on other highways/roads, occupied dwellings, and one school until an application to lease is filed.	Wyoming 450, I-90, and the cemetery are not located in the general analysis area. No schools are located in the general analysis area. One occupied dwelling is located west of the McGee Road in the BLM study area. Therefore, the area within the 300-foot buffer zone surrounding the occupied dwelling is designated as unsuitable for mining under Criterion 3 and the lease will be stipulated to exclude mining within this area. Portions of the Collins and McGee Roads, both Campbell County roads, are located within the general analysis area. Therefore, the portions of the general analysis area within the Collins and McGee road ROWs and their associated 100-foot buffer zones are designated unsuitable for mining under Criterion 3 and the lease will be stipulated to exclude mining within these areas unless a permit to move the roads is approved by the Campbell County Board of Commissioners.
4. **Wilderness Study Areas.** Federal lands designated as wilderness study areas are unsuitable for mining while under review for possible wilderness designation.	No lands in the general review area are within a wilderness study area.	No unsuitable findings under Criterion 4 apply to the general analysis area.
5. **Scenic Areas.** Scenic federal lands designated by visual resource management analysis as Class I (outstanding visual quality or high visual sensitivity) but not currently on National Register of Natural Landmarks are unsuitable.	No lands in the general review area meet the scenic criteria as outlined.	No unsuitable findings under Criterion 5 apply to the general analysis area.

Unsuitability Criteria	General Recommendations for Buffalo Resources Area[1]	Findings for General Analysis Area
6. **Land Used for Scientific Study.** Federal lands under permit by the surface management agency and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments are unsuitable for the duration of the study except where mining would not jeopardize the purpose of the study.	Two vegetation monitoring study sites on the Thunder Basin National Grassland (NE¼ of Sec. 1, T.41N., R.71W. and NW¼ NW¼ of Sec. 30, T.41N., R.69W.), and the Hoe Creek Site (Sec. 7, T.47N., R.72W.) were found to be unsuitable under this criterion.	The vegetation monitoring sites and the Hoe Creek site are not located in the general analysis area. Therefore, no unsuitable findings under Criterion 6 apply to the general analysis area.
7. **Cultural Resources.** All publicly or privately owned places which are included in or are eligible for inclusion in the National Register of Historic Places and an appropriate buffer zone are unsuitable.	On the basis of the consultation with the State Historic Preservation Office, there are sites within the general review area that are listed in the National Register of Historic Places. Continue using the "Standard Archeological Stipulation" on all new coal leases.	No unsuitable findings under Criterion 7 apply to the general analysis area. The "Standard Archeological Stipulation" should be applied if a lease is issued.
8. **Natural Areas.** Federal lands designated as natural areas or National Natural Landmarks are unsuitable.	No lands in the general review area are designated as natural areas or as National Natural Landmarks.	No unsuitable findings under Criterion 8 apply to the general analysis area.
9. **Critical Habitat for Threatened or Endangered Plant and Animal Species.** Federally designated critical habitat for threatened or endangered plant and animal species, and scientifically documented essential habitat for threatened or endangered species are unsuitable.	No federally designated critical habitat for threatened or endangered plant or animal species is present within the general review area.	No unsuitable findings under Criterion 9 apply to the general analysis area.
10. **State Listed Threatened or Endangered Species.** Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as threatened or endangered shall be considered unsuitable.	Wyoming does not maintain a state list of threatened or endangered species of plants or animals. Therefore, this criterion does not apply.	No unsuitable findings under Criterion 10 apply to the general analysis area.
11. **Bald or Golden Eagle Nests.** An active bald or golden eagle nest and appropriate buffer zone are unsuitable unless the lease can be conditioned so that eagles will not be disturbed during breeding season or unless golden eagle nests will be moved.	Defer suitability decisions and evaluate bald and golden eagle nests on a case by case basis at the time of leasing. Establish buffer zones around nests during mining and reclamation planning after consultation with USFWS.	No bald or golden eagle nests (active or inactive) are in the general analysis area. Evaluate suitability prior to lease issuance during consultation with the USFWS.
12. **Bald and Golden Eagle Roost and Concentration Areas.** Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering are unsuitable unless mining can be conducted in such a way as to ensure that eagles shall not be adversely disturbed.	Defer suitability decisions and evaluate bald and golden eagle roost areas on a case by case basis prior to lease issuance. Establish buffer zones after consultation with USFWS.	No identified roost sites are within the general analysis area. Evaluate suitability prior to lease issuance during consultation with the USFWS.

Unsuitability Criteria	General Recommendations for Buffalo Resources Area[1]	Findings for General Analysis Area
13. **Falcon Nesting Sites and Buffer Zones.** Federal lands containing active falcon (excluding kestrel) cliff nesting sites and a suitable buffer zone shall be considered unsuitable unless mining can be conducted in such a way as to ensure the falcons will not be adversely affected.	Defer suitability decisions on falcon nesting sites and evaluate on a case by case basis prior to lease issuance. Establish buffer zones around nesting sites after consultation with USFWS.	No falcon nesting sites have been identified within the general analysis area. No unsuitable findings under Criterion 13 apply to the general analysis area.
14. **Habitat for Migratory Bird Species.** Federal lands which are high priority habitat for migratory bird species of management concern in Wyoming shall be considered unsuitable unless mining can be conducted in such a way as to ensure that migratory bird habitat will not be adversely affected during the period it is in use.	Defer suitability decisions on high priority habitat for migratory bird species of management concern in Wyoming and evaluate on a case by case basis prior to lease issuance. Establish buffer zones for nesting areas during mining and reclamation planning after consultation with USFWS.	Evaluate suitability during consultation with the USFWS.
15. **Fish and Wildlife Habitat for Resident Species.** Federal lands which the surface management agency and state jointly agree are fish, wildlife and plant habitat of resident species of high interest to the state, and which are essential for maintaining these priority wildlife species, shall be considered unsuitable unless mining can be conducted in such a way as to ensure no long-term impact on the species being provided will occur.	Defer suitability decisions on grouse leks and evaluate on a case by case basis prior to lease issuance. Establish buffer zones after consultation with Wyoming Game & Fish Department.	No sage-grouse leks are present in the general analysis area. One abandoned and two occupied sage-grouse leks are within 3 miles of the general analysis area. Evaluate this criterion prior to lease issuance. Establish buffer zones during mining and reclamation planning after consultation with the Wyoming Game & Fish Department.
16. **Floodplains.** Federal lands in riverine, coastal, and special floodplains shall be considered unsuitable where it is determined that mining could not be undertaken without substantial threat of loss of life or property.	The BLM and United States Department of Agriculture-Forest Service have determined that the identified floodplains in the general review area could potentially be mined. Therefore, all lands within the general review area are considered suitable.	Site-specific stipulations and resource protection safeguards will be applied if necessary during mining and reclamation planning. No unsuitable findings under Criterion 16 apply to the general analysis area.
17. **Municipal Watersheds.** Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.	No designated municipal watersheds are present in the general review area.	No unsuitable findings under Criterion 17 apply to the general analysis area.
18. **National Resource Waters.** Federal lands with national resource waters, as identified by states in their water quality management plans, and 1/4-mile buffer zones shall be unsuitable.	No designated national resource waters are present within the general review area.	No unsuitable findings under Criterion 18 apply to the general analysis area.

Unsuitability Criteria	General Recommendations for Buffalo Resources Area[1]	Findings for General Analysis Area
19. **Alluvial Valley Floors.** Federal lands identified by the surface management agency, in consultation with the state, as AVFs where mining would interrupt, discontinue or preclude farming, are unsuitable. Additionally, when mining federal lands outside an AVF would materially damage the quality or quantity of water in surface or underground water systems that would supply AVFs, the land shall be considered unsuitable.	Consider areas determined to contain AVFs significant to farming as unsuitable. Defer decisions on other AVFs and analyze on a case-by-case basis prior to lease issuance.	No AVFs or potential AVFs have been identified in the general analysis area with characteristics indicating potential significance to farming. No unsuitable findings under Criterion 19 apply to the general analysis area.
20. **State or Indian Tribe Criteria.** Federal lands to which is applicable a criterion proposed by the state or Indian tribe located in the planning area and adopted by rulemaking by the Secretary are unsuitable.	No criterion proposed by state or Indian tribes have been approved by the Secretary of the Interior. No tribal lands are located in or near the general review area.	No unsuitability findings under Criterion 20 apply to the general analysis area.

BNSF = Burlington Northern Santa Fe Railroad; UP = Union Pacific Railroad; ROW = right of way; Wyoming 450 = Wyoming Highway 450; I-90 = Interstate Highway 90; BLM = U.S. Bureau of Land Management; USFWS = United States Fish and Wildlife Service; AVF = alluvial valley floor; kV = kilovolt

[1] BLM 1985. Buffalo Resource Area Resource Management Plan Environmental Impact Statement. Casper, Wyoming.

BLM 2001. Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office. Buffalo, WY. Available: <http://www.wy.blm.gov>.

APPENDIX C

COAL LEASE-BY-APPLICATION FLOW CHART

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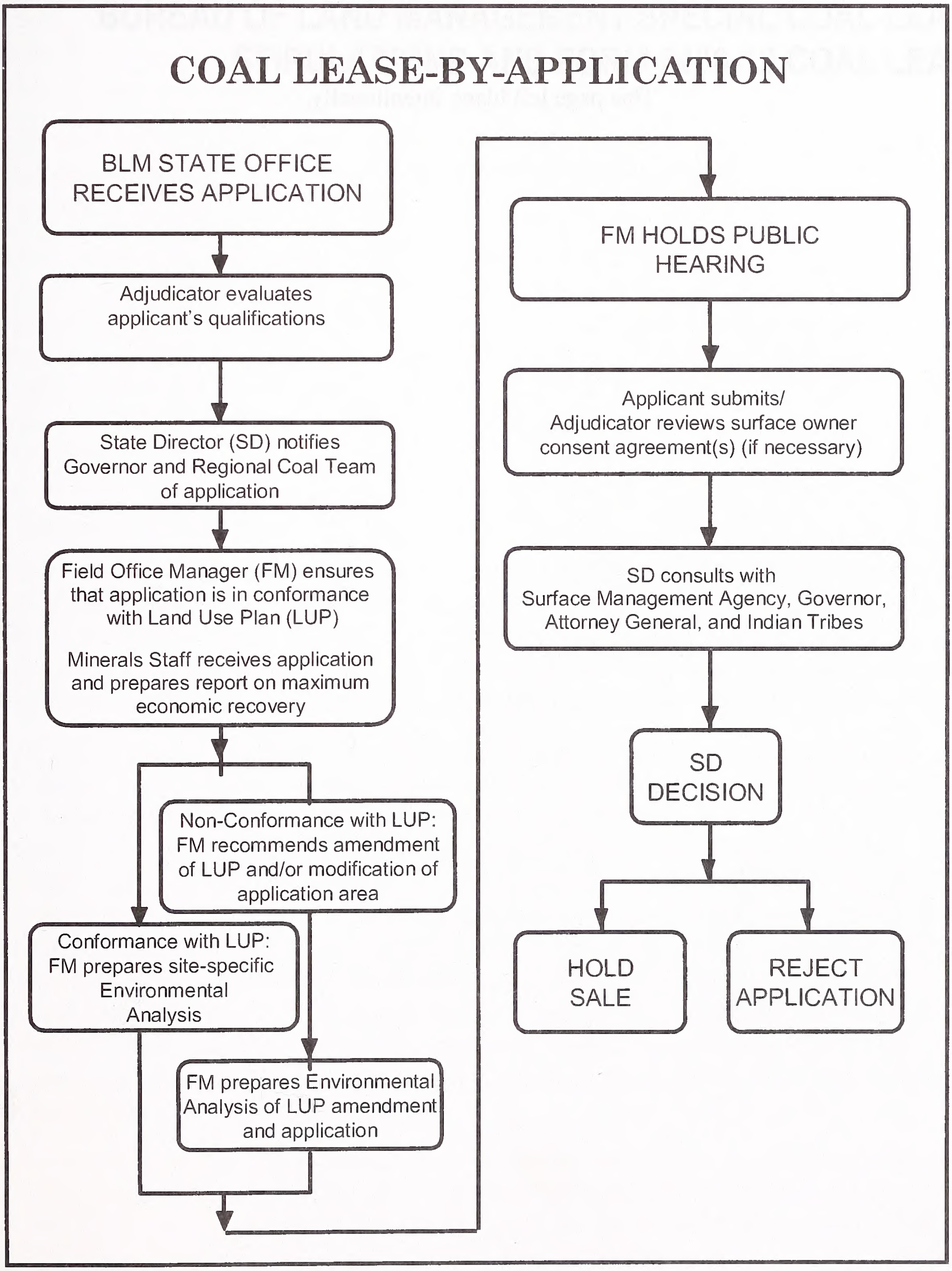
APPENDIX C: COAL LEASE-BY-APPLICATION FLOW CHART



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APPENDIX D

BUREAU OF LAND MANAGEMENT SPECIAL COAL LEASE STIPULATIONS AND FORM 3400-12 COAL LEASE

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APPENDIX D: BUREAU OF LAND MANAGEMENT SPECIAL COAL LEASE STIPULATIONS AND FORM 3400-12 COAL LEASE

The BLM will attach the following special stipulations to any mine permit issued under the Proposed Action or Alternative 2.

In addition to observing the general obligations and standards of performance set out in the current regulations, the lessee shall comply with and be bound by the following special stipulations.

These stipulations are also imposed upon the lessee's agents and employees. The failure or refusal of any of these persons to comply with these stipulations shall be deemed a failure of the lessee to comply with the terms of the lease. The lessee shall require his agents, contractors and subcontractors involved in activities concerning this lease to include these stipulations in the contracts between and among them. These stipulations may be revised or amended, in writing, by the mutual consent of the lessor and the lessee at any time to adjust to changed conditions or to correct an oversight.

(a) Cultural Resources

(1) Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the Authorized Officer of the BLM or of the surface managing agency, if different, on portions of the mine plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease-related activities and which were not previously inventoried at such a level of intensity.

The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archeologist, historian, historical architect, as appropriate), approved by the Authorized Officer of the surface managing agency (BLM, if the surface is privately owned), and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Regional Director of the Western Region of the Office of Surface Mining (the Western Regional Director), the Authorized Officer of the BLM, if activities are associated with coal exploration outside an approved mining permit area (hereinafter called Authorized Officer), and the Authorized Officer of the surface managing agency, if different. The lessee shall undertake measures, in accordance with instructions from the Western Regional Director, or Authorized Officer, to protect cultural resources on the leased lands. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the Western Regional Director or Authorized Officer.

(2) The lessee shall protect all cultural resource properties that have been determined eligible to the National Register of Historic Places within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of an approved mining and reclamation or exploration plan unless modified by mutual agreement in consultation with the State Historic Preservation Officer.

(3) The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

(4) If cultural resources are discovered during operations under this lease, the lessee shall immediately bring them to the attention of the Western Regional Director or Authorized Officer, or the Authorized Officer of the surface managing agency, if the Western Regional Director is not available. The lessee shall not disturb such resources except as may be subsequently authorized by the Western Regional Director or Authorized Officer.

Within two (2) working days of notification, the Western Regional Director or Authorized Officer will evaluate or have evaluated any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the lessee unless otherwise specified by the Authorized Officer of the BLM or of the surface managing agency, if different.

(5) All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

(b) Paleontological Resources

If paleontological resources, either large and conspicuous and/or of significant scientific value are discovered during mining operations, the find will be reported to the Authorized Officer immediately. Mining operations will be suspended within 250 feet of said find. The find will be stabilized and protected to minimize adverse impacts. An evaluation of the paleontological discovery will be made by a BLM-approved professional paleontologist within five (5) working days, weather permitting, to determine the appropriate action(s) to prevent the potential loss of any significant paleontological value. Operations within 250 feet of such discovery will not be resumed until written authorization to proceed is issued by the Authorized Officer. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operations.

(c) Threatened, Endangered, Candidate, or Other Special Status Plant and Animal Species

(1) The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened or endangered under the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., or that have other special status. The Authorized Officer may recommend modifications to exploration and development proposals to further conservation and management objectives or to avoid activity that will contribute to a need to list such species or their habitat or to comply with any biological opinion issued by the Fish and Wildlife Service for the Proposed Action. The Authorized Officer will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act. The Authorized Officer may require modifications

to, or disapprove a proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species, or result in the destruction or adverse modification of designated or proposed critical habitat.

(2) The lessee shall comply with instructions from the Authorized Officer of the surface managing agency (BLM, if the surface is private) for ground disturbing activities associated with coal exploration on federal coal leases prior to approval of a mining and reclamation permit or outside an approved mining and reclamation permit area. The lessee shall comply with instructions from the Authorized Officer of the Office of Surface Mining Reclamation and Enforcement, or his designated representative, for all ground disturbing activities taking place within an approved mining and reclamation permit area or associated with such a permit.

(3) Any potential habitat that has not already been surveyed for Ute ladies' tresses within the project area shall be identified and surveyed prior to surface mining activities.

(d) Multiple Mineral Development

Operations will not be approved which, in the opinion of the Authorized Officer, would unreasonably interfere with the orderly development and/or production from a valid existing mineral lease issued prior to this one for the same lands.

(e) Oil and Gas/Coal Resources

The BLM realizes that coal mining operations conducted on Federal coal leases issued within producing oil and gas fields may interfere with the economic recovery of oil and gas; just as Federal oil and gas leases issued in a Federal coal lease area may inhibit coal recovery. The BLM retains the authority to alter and/or modify the resource recovery and protection plans for coal operations and/or oil and gas operations on those lands covered by Federal mineral leases so as to obtain maximum resource recovery.

(f) Resource Recovery and Protection

Notwithstanding the approval of a resource recovery and protection plan (R^2P^2) by the BLM, the lessor reserves the right to seek damages against the operator/lessee in the event (i) the operator/lessee fails to achieve maximum economic recovery (MER) (as defined at 43 CFR 3480.0-5(21)) of the recoverable coal reserves or (ii) the operator/lessee is determined to have caused a wasting of recoverable coal reserves. Damages shall be measured on the basis of the royalty that would have been payable on the wasted or unrecovered coal.

The parties recognize that under an approved R^2P^2, conditions may require a modification by the operator/lessee of that plan. In the event a coal bed or portion thereof is not to be mined or is rendered unmineable by the operation, the operator/lessee shall submit appropriate justification to obtain approval by the Authorized Officer to leave such reserves unmined. Upon approval by the Authorized Officer, such coal beds or portions thereof shall not be subject to damages as

described above. Further, nothing in this section shall prevent the operator/lessee from exercising its right to relinquish all or portion of the lease as authorized by statute and regulation.

In the event the Authorized Officer determines that the R^2P^2, as approved, will not attain MER as the result of changed conditions, the Authorized Officer will give proper notice to the operator/lessee as required under applicable regulations. The Authorized Officer will order a modification if necessary, identifying additional reserves to be mined in order to attain MER. Upon a final administrative or judicial ruling upholding such an ordered modification, any reserves left unmined (wasted) under that plan will be subject to damages as described in the first paragraph under this section.

Subject to the right to appeal hereinafter set forth, payment of the value of the royalty on such unmined recoverable coal reserves shall become due and payable upon determination by the Authorized Officer that the coal reserves have been rendered unmineable or at such time that the operator/lessee has demonstrated an unwillingness to extract the coal.

The BLM may enforce this provision either by issuing a written decision requiring payment of the Mineral Management Service demand for such royalties, or by issuing a notice of non-compliance. A decision or notice of non-compliance issued by the lessor that payment is due under this stipulation is appealable as allowed by law.

(g) Public Land Survey Protection

The lessee will protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage during operations on the lease areas. If any monuments, corners or accessories are destroyed, obliterated, or damaged by this operation, the lessee will hire an appropriate county surveyor or registered land surveyor to reestablish or restore the monuments, corners, or accessories at the same location, using surveying procedures in accordance with the "Manual of Surveying Instructions for the Survey of the Public Lands of the United States." The survey will be recorded in the appropriate county records, with a copy sent to the Authorized Officer.

(h) Buffer Zones For Rights-of-Way of Public Roads, School Buildings, and Occupied Dwellings

(1) No mining activity of any kind may be conducted within the Collins or McGee road rights-of-way and associated 100-foot buffer zones. The lessee shall recover all legally and economically recoverable coal from all leased lands not within the foregoing rights-of-way and associated buffer zones. Provided a permit to move the roads is approved by the Campbell County Board of Commissioners, the lessee shall recover all legally and economically recoverable coal from all leased lands within the foregoing rights-of-way and associated buffer zones. The lessee shall pay all royalties on any legally and economically recoverable coal that it fails to mine without the written permission of the Authorized Officer.

(2) No mining activity of any kind may be conducted within occupied residence and associated 100-foot buffer zone. The lessee shall recover all legally and economically recoverable coal from all leased lands not within the foregoing occupied residence and associated buffer zone. Provided a permit to move the cemetery is approved by the Campbell County Cemetery District, the lessee shall recover all legally and economically recoverable coal from all leased lands within the foregoing cemetery and associated buffer zone. The lessee shall pay all royalties on any legally and economically recoverable coal that it fails to mine without the written permission of the Authorized Officer.

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Form 3400-12
(February 2005)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0073
Expires: January 31, 2007

Serial Number

COAL LEASE

PART 1. LEASE RIGHTS GRANTED

This lease, entered into by and between the UNITED STATES OF AMERICA, hereinafter called lessor, through the Bureau of Land Management (BLM), and *(Name and Address)*

hereinafter called lessee, is effective *(date)* / / , for a period of 20 years and for so long thereafter as coal is produced in commercial quantities from the leased lands, subject to readjustment of lease terms at the end of the 20th lease year and each 10-year period thereafter.

Sec. 1. This lease is issued pursuant and subject to the terms and provisions of the:

☐ Mineral Lands Leasing Act of 1920, Act of February 25, 1920, as amended, 41 Stat. 437, 30 U.S.C. 181-287, hereinafter referred to as the Act;

☐ Mineral Leasing Act for Acquired Lands, Act of August 7, 1947, 61 Stat. 913, 30 U.S.C. 351-359;

and to the regulations and formal orders of the Secretary of the Interior which are now or hereafter in force, when not inconsistent with the express and specific provisions herein.

Sec. 2. Lessor, in consideration of any bonuses, rents, and royalties to be paid, and the conditions and covenants to be observed as herein set forth, hereby grants and leases to lessee the exclusive right and privilege to drill for, mine, extract, remove, or otherwise process and dispose of the coal deposits in, upon, or under the following described lands:

containing acres, more or less, together with the right to construct such works, buildings, plants, structures, equipment and appliances and the right to use such on-lease rights-of-way which may be necessary and convenient in the exercise of the rights and privileges granted, subject to the conditions herein provided.

PART II. TERMS AND CONDITIONS

Sec. 1. (a) RENTAL RATE -Lessee must pay lessor rental annually and in advance for each acre or fraction thereof during the continuance of the lease at the rate of $ for each lease year.

(b) RENTAL CREDITS -Rental will not be credited against either production or advance royalties for any year.

Sec. 2. (a) PRODUCTION ROYALTIES - The royalty will be percent of the value of the coal as set forth in the regulations. Royalties are due to lessor the final day of the month succeeding the calendar month in which the royalty obligation accrues.

(b) ADVANCE ROYALTIES - Upon request by the lessee, the BLM may accept, for a total of not more than 10 years, the payment of advance royalties in lieu of continued operation, consistent with the regulations. The advance royalty will be based on a percent of the value of a minimum number of tons determined in the manner established by the advance royalty regulations in effect at the time the lessee requests approval to pay advance royalties in lieu of continued operation.

Sec. 3. BONDS - Lessee must maintain in the proper office a lease bond in the amount of $. The BLM may require an increase in this amount when additional coverage is determined appropriate.

Sec. 4. DILIGENCE - This lease is subject to the conditions of diligent development and continued operation, except that these conditions are excused when operations under the lease are interrupted by strikes, the elements, or casualties not attributable to the lessee. The lessor, in the public interest, may suspend the condition of continued operation upon payment of advance royalties in accordance with the regulations in existence at the time of the suspension. Lessee's failure to produce coal in commercial quantities at the end of 10 years will terminate the lease. Lessee must submit an operation and reclamation plan pursuant to Section 7 of the Act not later than 3 years after lease issuance.

The lessor reserves the power to assent to or order the suspension of the terms and conditions of this lease in accordance with, inter alia, Section 39 of the Mineral Leasing Act, 30 U.S.C. 209.

5. LOGICAL MINING UNIT (LMU) - Either upon approval by the lessor of the lessee's application or at the direction of the lessor, this lease will become an LMU or part of an LMU, subject to the provisions set forth in the regulations.

The stipulations established in an LMU approval in effect at the time of LMU approval will supersede the relevant inconsistent terms of this lease so long as the lease remains committed to the LMU. If the LMU of which this lease is a part is dissolved, the lease will then be subject to the lease terms which would have been applied if the lease had not been included in an LMU.

(Continued on page 2)

Sec. 6. DOCUMENTS, EVIDENCE AND INSPECTION - At such times and in such form as lessor may prescribe, lessee must furnish detailed statements showing the amounts and quality of all products removed and sold from the lease, the proceeds therefrom, and the amount used for production purposes or unavoidably lost.

Lessee must keep open at all reasonable times for the inspection by BLM the leased premises and all surface and underground improvements, works, machinery, ore stockpiles, equipment, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or under the leased lands.

Lessee must allow lessor access to and copying of documents reasonably necessary to verify lessee compliance with terms and conditions of the lease.

While this lease remains in effect, information obtained under this section will be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 7. DAMAGES TO PROPERTY AND CONDUCT OF OPERATIONS - Lessee must comply at its own expense with all reasonable orders of the Secretary, respecting diligent operations, prevention of waste, and protection of other resources.

Lessee must not conduct exploration operations, other than casual use, without an approved exploration plan. All exploration plans prior to the commencement of mining operations within an approved mining permit area must be submitted to the BLM.

Lessee must carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health, or property, and prevention of waste, damage or degradation to any land, air, water, cultural, biological, visual, and other resources, including mineral deposits and formations of mineral deposits not leased hereunder, and to other land uses or users. Lessee must take measures deemed necessary by lessor to accomplish the intent of this lease term. Such measures may include, but are not limited to, modification to proposed siting or design of facilities, timing of operations, and specification of interim and final reclamation procedures. Lessor reserves to itself the right to lease, sell, or otherwise dispose of the surface or other mineral deposits in the lands and the right to continue existing uses and to authorize future uses upon or in the leased lands, including issuing leases for mineral deposits not covered hereunder and approving easements or rights-of-way. Lessor must condition such uses to prevent unnecessary or unreasonable interference with rights of lessee as may be consistent with concepts of multiple use and multiple mineral development.

Sec. 8. PROTECTION OF DIVERSE INTERESTS, AND EQUAL OPPORTUNITY - Lessee must: pay when due all taxes legally assessed and levied under the laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at least twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; restrict the workday to not more than 8 hours in any one day for underground workers, except in emergencies; and take measures necessary to protect the health and safety of the public. No person under the age of 16 years should be employed in any mine below the surface. To the extent that laws of the State in which the lands are situated are more restrictive than the provisions in this paragraph, then the State laws apply.

Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and the rules, regulations, and relevant orders of the Secretary of Labor. Neither lessee nor lessee's subcontractors should maintain segregated facilities.

Sec. 9. (a) TRANSFERS

- ☐ This lease may be transferred in whole or in part to any person, association or corporation qualified to hold such lease interest.
- ☐ This lease may be transferred in whole or in part to another public body or to a person who will mine coal on behalf of, and for the use of, the public body or to a person who for the limited purpose of creating a security interest in favor of a lender agrees to be obligated to mine the coal on behalf of the public body.
- ☐ This lease may only be transferred in whole or in part to another small business qualified under 13 CFR 121.

Transfers of record title, working or royalty interest must be approved in accordance with the regulations.

(b) RELINQUISHMENT - The lessee may relinquish in writing at any time all rights under this lease or any portion thereof as provided in the regulations. Upon lessor's acceptance of the relinquishment, lessee will be relieved of all future obligations under the lease or the relinquished portion thereof, whichever is applicable.

Sec. 10. DELIVERY OF PREMISES, REMOVAL OF MACHINERY, EQUIPMENT, ETC. - At such time as all portions of this lease are returned to lessor, lessee must deliver up to lessor the land leased, underground timbering, and such other supports and structures necessary for the preservation of the mine workings on the leased premises or deposits and place all workings in condition for suspension or abandonment. Within 180 days thereof, lessee must remove from the premises all other structures, machinery, equipment, tools, and materials that it elects to or as required by the BLM. Any such structures, machinery, equipment, tools, and materials remaining on the leased lands beyond 180 days, or approved extension thereof, will become the property of the lessor, but lessee may either remove any or all such property or continue to be liable for the cost of removal and disposal in the amount actually incurred by the lessor. If the surface is owned by third parties, lessor will waive the requirement for removal, provided the third parties do not object to such waiver. Lessee must, prior to the termination of bond liability or at any other time when required and in accordance with all applicable laws and regulations, reclaim all lands the surface of which has been disturbed, dispose of all debris or solid waste, repair the offsite and onsite damage caused by lessee's activity or activities incidental thereto, and reclaim access roads or trails.

Sec. 11. PROCEEDINGS IN CASE OF DEFAULT - If lessee fails to comply with applicable laws, existing regulations, or the terms, conditions and stipulations of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease will be subject to cancellation by the lessor only by judicial proceedings. This provision will not be construed to prevent the exercise by lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver will not prevent later cancellation for the same default occurring at any other time.

Sec. 12. HEIRS AND SUCCESSORS-IN-INTEREST - Each obligation of this lease will extend to and be binding upon, and every benefit hereof will inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 13. INDEMNIFICATION -Lessee must indemnify and hold harmless the United States from any and all claims arising out of the lessee's activities and operations under this lease.

Sec. 14. SPECIAL STATUTES - This lease is subject to the Clean Water Act (33 U.S.C. 1252 et seq.), the Clean Air Act (42 U.S.C. 4274 et seq.), and to all other applicable laws pertaining to exploration activities, mining operations and reclamation, including the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 et seq.).

Sec. 15. SPECIAL STIPULATIONS

(Continued on page 3)

THE UNITED STATES OF AMERICA

(Company or Lessee Name)	By
(Signature of Lessee)	(BLM)
(Title)	(Title)
(Date)	(Date)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

NOTICES

The Privacy Act of 1974 and the regulation in 43 CFR 2.48(d) provide that you be furnished with the following information in connection with information required by this application.
AUTHORITY: 30 U.S.C. 181-287 and 30 U.S.C. 351-359.
PRINCIPAL PURPOSE: BLM will use the information you provide to process your application and determine if you are eligible to hold a lease on BLM Land.
ROUTINE USES: BLM will only disclose the information according to the regulations at 43 CFR 2.56(d).
EFFECT OF NOT PROVIDING INFORMATION: Disclosing the information is necessary to receive a benefit. Not disclosing the information may result in BLM's rejecting your request for a lease.

The Paperwork Reduction Act of 1995 requires us to inform you that:
The BLM collects this information to authorize and evaluate proposed exploration and mining operations on public lands.
Response to the provisions of this lease form is mandatory for the types of activities specified.
The BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN HOURS STATEMENT: Public reporting burden for this form is estimated to average one hour per response including the time for reading the instructions and provisions, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to U.S. Department of the Interior, Bureau of Land Management (1004-0073), Bureau Information Collection Clearance Officer (WO-630), 1849 C Street, Mail Stop 401 LS, Washington, D.C. 20240.

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APPENDIX E

CBNG AND CONVENTIONAL OIL AND GAS WELLS CAPABLE OF PRODUCTION IN THE GENERAL ANALYSIS AREA

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APPENDIX E: CBNG AND CONVENTIONAL OIL AND GAS WELLS CAPABLE OF PRODUCTION IN THE GENERAL ANALYSIS AREA

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
531855	HALL - NO. 13C-622	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	6	52	N	72	W	PS	121,383	135,842
532495	FRANKLIN - NO. 24C-622	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	6	52	N	72	W	PS	81,449	341,035
532823	HALL - NO. 12C-622	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	6	52	N	72	W	PS	159,507	366,692
532824	FRANKLIN - NO. 23C-622	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	6	52	N	72	W	PS	95,851	186,499
533102	FRANKLIN - NO. 33C-622	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	6	52	N	72	W	PS	124,372	172,496
533263	FRANKLIN - NO. 14C-622	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	6	52	N	72	W	PS	81,444	300,449
533412	FRANKLIN - NO. 34C-622	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	6	52	N	72	W	PS	78,230	119,336
533932	FRANKLIN - NO. 43C-622	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	6	52	N	72	W	PS	82,874	0
534847	FRANKLIN - NO. 44C-622	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	6	52	N	72	W	SI	10,396	7,913
539851	LANDECK - NO. 32C-622	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	6	52	N	72	W	PS	84,613	0
532180	OEDEKOVEN - NO. 11C-722	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	7	52	N	72	W	PS	63,518	280,080
532181	OEDEKOVEN - NO. 13C-722	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	7	52	N	72	W	PS	72,789	185,190
532183	OEDEKOVEN - NO. 22C-722	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	7	52	N	72	W	PS	111,840	150,074
532494	FRANKLIN - NO. 24C-722	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	7	52	N	72	W	PS	98,315	175,506
533103	OEDEKOVEN - NO. 33C-722	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	7	52	N	72	W	PS	83,843	183,424
533413	FRANKLIN - NO. 42C-722	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	7	52	N	72	W	PS	230,948	98,166
533414	FRANKLIN - NO. 41C-722	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	7	52	N	72	W	PS	244,254	31,518
534651	FRANKLIN - NO. 14C-722	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	7	52	N	72	W	PS	27,870	140,417
538705	OEDEKOVEN - NO. 21C-722	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	7	52	N	72	W	PS	19,762	36,156
536570	TAYLOR - NO. 21C-822	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	8	52	N	72	W	PS	21,651	47,635

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
536757	TAYLOR - NO. 12C-822	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	8	52	N	72	W	PS	167,514	80
553318	HALL - NO. 43C-822	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	8	52	N	72	W	PS	60,956	41,000
549231	TRITON - NO. 34AC-1722	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	17	52	N	72	W	SI	178,004	724,975
549232	TRITON - NO. 43AC-1722	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	17	52	N	72	W	SI	111,133	400,441
549233	TRITON - NO. 44AC-1722	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	17	52	N	72	W	SI	69,389	306,563
551182	TRITON - NO. 13C-1722	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	17	52	N	72	W	SI	62,196	0
551183	TRITON - NO. 14C-1722	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	17	52	N	72	W	SI	114,111	0
551185	TRITON - NO. 12C-1722	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	17	52	N	72	W	SI	90,978	0
532182	OEDEKOVEN - NO. 13C-1822	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	18	52	N	72	W	SI	92,863	219,635
532432	FRANKLIN - NO. 14C-1822	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	18	52	N	72	W	PS	207,892	207,583
532434	FRANKLIN - NO. 24A-1822	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	18	52	N	72	W	PS	195,615	410,008
532436	FRANKLIN - NO. 33C-1822	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	18	52	N	72	W	SI	51,196	935,318
532501	FRANKLIN - NO. 22C-1822	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	18	52	N	72	W	PS	148,749	197,409
532502	FRANKLIN - NO. 11C-1822	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	18	52	N	72	W	SI	57,310	139,916
533104	FRANKLIN - NO. 31C-1822	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	18	52	N	72	W	PS	125,735	473,661
535022	OEDEKOVEN - NO. 12C-1822	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	18	52	N	72	W	PS	62,599	177,945
535592	MCGEE - NO. 21C-1822	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	18	52	N	72	W	PS	64,077	169,394
547734	FRANKLIN - NO. 24CR-1822	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	18	52	N	72	W	PS	106,238	410,780
531397	TRITON - NO. 24C-1922	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	19	52	N	72	W	PS	249,295	159,132
531398	TRITON - NO. 14A-1922	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	19	52	N	72	W	PS	22,932	4,371
532163	OEDEKOVEN - NO. 11C-1922	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	19	52	N	72	W	PS	141,610	520,325
532411	FRANKLIN - NO. 31C-1922	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	19	52	N	72	W	PS	179,637	1,604,364
533494	BUCKSKIN - NO. 42C-1922	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	19	52	N	72	W	SI	175	132,944

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
538839	TRITON - NO. 14C-1922	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	19	52	N	72	W	PS	65,974	186,303
533495	BUCKSKIN - NO. 12C-2022	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	20	52	N	72	W	PS	125,432	239,416
533496	BUCKSKIN - NO. 14C-2022	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	20	52	N	72	W	SI	231	7,374
533497	BUCKSKIN - NO. 13C-2022	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	20	52	N	72	W	SI	137	17,958
549234	TRITON - NO. 31AC-2022	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	20	52	N	72	W	SI	225,285	359,851
549235	TRITON - NO. 32AC-2022	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	20	52	N	72	W	SI	93,150	564,878
549236	TRITON - NO. 41AC-2022	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	20	52	N	72	W	SI	105,529	103,900
533493	BUCKSKIN - NO. 11C-2922	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	29	52	N	72	W	PS	77,267	495,376
533498	BUCKSKIN - NO. 21C-2922	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	29	52	N	72	W	SI	6,004	0
530083	ROUGH DRAW - NO. P30-14	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	30	52	N	72	W	PS	10,763	3,720
531028	OEDEKOVEN - NO. 32C-3022	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	30	52	N	72	W	PS	40,510	24,067
531240	TRITON - NO. 12C-3022	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	30	52	N	72	W	SI	123,028	437,847
531241	TRITON - NO. 13C-3022	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	30	52	N	72	W	PS	182,618	361,305
531243	TRITON - NO. 24C-3022	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	30	52	N	72	W	PS	186,775	378,861
531280	TRITON - NO. 14C-3022	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	30	52	N	72	W	PS	195,705	267,977
531402	TRITON - NO. 11A-3022	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	30	52	N	72	W	PS	139,085	0
531403	TRITON - NO. 12A-3022	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	30	52	N	72	W	PS	70,971	702
531404	TRITON - NO. 13A-3022	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	30	52	N	72	W	PS	39,382	3,600
531405	TRITON - NO. 14A-3022	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	30	52	N	72	W	PS	47,799	3,086
531439	TRITON - NO. 21C2	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	30	52	N	72	W	PS	173,059	423,907
531675	TRITON FEDERAL - NO. 22C	MAJESTIC PETROLEUM OPERATIONS INC	SE	1/4	NW	1/4	Sec	30	52	N	72	W	PS	150,679	239,193
532768	OEDEKOVEN - NO. 32C2-3022	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	30	52	N	72	W	PS	167,683	485,388
533499	BUCKSKIN - NO. 41C-3022	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	30	52	N	72	W	PS	130,651	291,125

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
533500	BUCKSKIN - NO. 42C-3022	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	30	52	N	72	W	PS	44,089	349,312
550829	TRITON - NO. 24A-3022	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	30	52	N	72	W	PS	35,216	0
531029	MARQUISS - NO. 24A-3122	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	31	52	N	72	W	PS	113,260	0
531045	OEDEKOVEN - NO. 12A-3122	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	31	52	N	72	W	PS	124,280	5,839
531157	TRITON - NO. 11A-3122	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	31	52	N	72	W	PS	74,478	0
531163	TRITON - NO. 13A-3122	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	31	52	N	72	W	PS	28,158	0
531167	TRITON - NO. 22A-3122	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	31	52	N	72	W	PS	50,480	5,486
531220	TRITON - NO. 11C-3122	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	31	52	N	72	W	PS	168,644	200,163
531221	TRITON - NO. 22C-3122	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	31	52	N	72	W	PS	304,212	338,365
531222	CABALLO - NO. 24C-3122	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	31	52	N	72	W	PS	562,778	184,935
531399	TRITON - NO. 12C-3122	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	31	52	N	72	W	PS	170,168	119,414
531438	CABALLO - NO. 14C-31	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	31	52	N	72	W	PS	323,148	736,288
531817	TRITON - NO. 23A-3122	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	31	52	N	72	W	PS	65,028	0
541502	RAWHIDE - NO. 14-5	MEDALLION EXPLORATION	SE	1/4	SW	1/4	Sec	5	51	N	72	W	SI	9	2,291
541508	RAWHIDE - NO. 13-5	MEDALLION EXPLORATION	SW	1/4	SW	1/4	Sec	5	51	N	72	W	SI	210	2,204
531476	CABALLO - NO. 22C-612	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	NW	1/4	Sec	6	51	N	72	W	SI	263,944	362,945
532613	CABALLO - NO. 21C-612	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	6	51	N	72	W	SI	309,754	359,022
533006	CABALLO STATE TFU - NO. 13A-612	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SW	1/4	Sec	6	51	N	72	W	SI	24,670	62
533265	CABALLO TFU - NO. 34C-612	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	6	51	N	72	W	SI	115,877	437,553
533319	CABALLO FEDERAL TFU - NO. 11C-612	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NW	1/4	Sec	6	51	N	72	W	PS	134,952	63,135
531855	HALL - NO. 13C-622	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	6	52	N	72	W	PS	121,383	135,842
532495	FRANKLIN - NO. 24C-622	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	6	52	N	72	W	PS	81,449	341,035

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532823	HALL - NO. 12C-622	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	6	52	N	72	W	PS	159,507	366,692
532824	FRANKLIN - NO. 23C-622	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	6	52	N	72	W	PS	95,851	186,499
533102	FRANKLIN - NO. 33C-622	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	6	52	N	72	W	PS	124,372	172,496
533263	FRANKLIN - NO. 14C-622	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	6	52	N	72	W	PS	81,444	300,449
533412	FRANKLIN - NO. 34C-622	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	6	52	N	72	W	PS	78,230	119,336
533932	FRANKLIN - NO. 43C-622	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	6	52	N	72	W	PS	82,874	0
534847	FRANKLIN - NO. 44C-622	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	6	52	N	72	W	SI	10,396	7,913
539851	LANDECK - NO. 32C-622	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	6	52	N	72	W	PS	84,613	0
540285	DALY - NO. 11A-113	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	1	51	N	73	W	PG	51,521	112,711
532397	CABALLO - NO. 44C-113	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SE	1/4	Sec	1	51	N	73	W	PS	316,318	200,591
533009	CABALLO TFU - NO. 42C-113	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	NE	1/4	Sec	1	51	N	73	W	SI	164,601	472,984
533010	CABALLO TFU - NO. 31C-113	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NE	1/4	Sec	1	51	N	73	W	SI	65,800	196,709
533894	20 MILE TFU - NO. 13C-113	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SW	1/4	Sec	1	51	N	73	W	SI	114,039	304,216
534597	DALY - NO. 23C-113	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	1	51	N	73	W	PS	101,441	219,802
534598	DALY - NO. 22C-113	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	1	51	N	73	W	PS	86,049	177,893
534599	DALY - NO. 11C-113	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	1	51	N	73	W	SI	97,690	169,034
534600	DALY - NO. 21C-113	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	1	51	N	73	W	PS	104,102	166,826
535179	DALY - NO. 33C-113	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	1	51	N	73	W	PS	134,385	62,364
537483	20 MILE - NO. 24A-113	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SW	1/4	Sec	1	51	N	73	W	PS	70,685	234,278
537484	20 MILE - NO. 24C-113	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SW	1/4	Sec	1	51	N	73	W	SI	119,949	132,627
540286	DALY - NO. 21A-113	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	1	51	N	73	W	PS	9,365	25,679
540287	DALY - NO. 23A-113	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	1	51	N	73	W	PS	44,643	13,138

API Number	Well Name	Company					Location						WOGCC Status	Gas MCF	Water BBLS
540288	DALY - NO. 22A-113	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	1	51	N	73	W	PS	30,643	34,640
540550	DALY - NO. 33A-113	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	1	51	N	73	W	SI	28,860	39,408
534604	DALY - NO. 11C-213	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	2	51	N	73	W	SI	35,053	182,993
535180	DALY - NO. 21C-213	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	2	51	N	73	W	SI	169,654	113,188
536515	DALY - NO. 22C-213	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	2	51	N	73	W	PS	235,809	185,098
537485	20 MILE - NO. 31C-213	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NE	1/4	Sec	2	51	N	73	W	SI	58,998	119,380
537486	20 MILE - NO. 31A-213	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NE	1/4	Sec	2	51	N	73	W	SI	20,621	159,517
537487	20 MILE - NO. 42C-213	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	NE	1/4	Sec	2	51	N	73	W	SI	46,185	355,673
537488	20 MILE - NO. 42A-213	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	NE	1/4	Sec	2	51	N	73	W	PS	107,076	11,140
538638	20 MILE - NO. 33A-213	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SE	1/4	Sec	2	51	N	73	W	SI	51,302	119,994
538713	20 MILE - NO. 33C-213	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SE	1/4	Sec	2	51	N	73	W	SI	221,577	469,491
540295	DALY - NO. 11A-213	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	2	51	N	73	W	PS	62,836	23,834
540551	DALY - NO. 21A-213	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	2	51	N	73	W	SI	80,764	20,196
531098	HALL - NO. 13C-123	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SW	1/4	Sec	1	52	N	73	W	PS	261,918	154,008
531099	HALL - NO. 23C-123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	1	52	N	73	W	SI	162,596	168,204
532184	HALL - NO. 42C-123	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	1	52	N	73	W	PS	127,917	71,088
532185	HALL - NO. 44C-123	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	1	52	N	73	W	PS	115,792	255,284
532665	HALL - NO. 14C-123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	1	52	N	73	W	PS	219,804	121,881
532666	HALL - NO. 31C-123	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	1	52	N	73	W	PS	209,361	126,816
532667	HALL - NO. 22C-123	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	NW	1/4	Sec	1	52	N	73	W	PS	146,657	440,204

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532668	HALL - NO. 11C-123	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NW	1/4	Sec	1	52	N	73	W	PS	196,065	533,085
532732	HALL - NO. 33C-123	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	1	52	N	73	W	PS	256,223	102,466
532825	HALL - NO. 41C-123	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	1	52	N	73	W	PS	178,358	109,820
545439	HALL - NO. 41A-123	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	1	52	N	73	W	PS	10,567	0
553317	HALL - NO. 42A-123	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	1	52	N	73	W	PS	8,571	93,310
531048	HALL - NO. 31C-223	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NE	1/4	Sec	2	52	N	73	W	PS	323,206	941,372
531051	HALL - NO. 34C-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	2	52	N	73	W	SI	32,040	370,957
531052	HALL - NO. 43C-223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	2	52	N	73	W	PS	265,148	693,211
533105	LANDECK - NO. 12C-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	2	52	N	73	W	PS	193,061	333,355
534792	LANDECK - NO. 14C-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	2	52	N	73	W	SI	219,639	393,528
535593	LANDECK - NO. 23C-223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	2	52	N	73	W	PS	103,609	420,615
536142	LANDECK FED - NO. 21C-223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	2	52	N	73	W	PS	80,482	140,086
544066	HALL - NO. 43WA-223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	2	52	N	73	W	PS	22,398	290,727
544068	LANDECK - NO. 12WA-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	2	52	N	73	W	SI	13,784	67,081
544069	LANDECK - NO. 14WA-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	2	52	N	73	W	PS	182,816	178,325
545431	LANDECK - NO. 12A-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	2	52	N	73	W	PS	47,905	166,401
545432	LANDECK - NO. 14A-223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	2	52	N	73	W	SI	27,879	0

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
530937	LANDECK - NO. 34C-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	3	52	N	73	W	PS	255,635	376,042
531023	LANDECK - NO. 23C-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	3	52	N	73	W	PS	102,119	613,178
531025	LANDECK - NO. 43C-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	3	52	N	73	W	PS	259,118	371,488
531040	LANDECK - NO. 32C-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	3	52	N	73	W	SI	113,192	178,447
531858	LANDECK FED - NO. 14C-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	3	52	N	73	W	PS	223,299	1,067,318
532907	LANDECK - NO. 23WA-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	3	52	N	73	W	PS	38,594	1,039,972
533107	LANDECK - NO. 41C-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	3	52	N	73	W	PS	275,199	379,410
533713	LANDECK - NO. 24B-323	REDSTONE RESOURCES INC	SE	1/4	SW	1/4	Sec	3	52	N	73	W	SI	0	0
533714	LANDECK - NO. 34WA-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	3	52	N	73	W	PS	14,154	16,449
535501	LANDECK - NO. 24B2-323	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SW	1/4	Sec	3	52	N	73	W	PS	147,759	319,976
544049	LANDECK - NO. 43WA2-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	3	52	N	73	W	PS	267,761	273,267
544050	LANDECK - NO. 32WA-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	3	52	N	73	W	PS	82,702	334,203
545424	LANDECK - NO. 43A-323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	3	52	N	73	W	SI	18,422	26,483
545426	LANDECK - NO. 34A-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	3	52	N	73	W	SI	41,519	16,951
545427	LANDECK - NO. 32A-323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	3	52	N	73	W	PS	77,128	282,476
531744	LANDECK - NO. 21WA-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	10	52	N	73	W	PS	459,324	663,863

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
531877	LANDECK - NO. 21C-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	10	52	N	73	W	PS	692,956	1,323,828
532326	HINKES - NO. 41C-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	10	52	N	73	W	PS	352,366	922,495
532329	LANDECK - NO. 23C-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	10	52	N	73	W	FL	147,285	1,061,655
532330	HINKES - NO. 43C-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	10	52	N	73	W	FL	409,021	769,558
532331	HINKES - NO. 34C-1023	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	10	52	N	73	W	PS	445,392	792,442
532487	HINKES - NO. 32WA-1023	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	10	52	N	73	W	PS	274,450	1,096,039
544025	LANDECK - NO. 23WA-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	10	52	N	73	W	PS	202,249	284,576
544028	HINKES - NO. 34WA-1023	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	10	52	N	73	W	PS	109,555	282,473
544081	LANDECK - NO. 21A-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	10	52	N	73	W	SI	3,403	276,814
544082	HINKES - NO. 43A-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	10	52	N	73	W	SI	132,200	45,322
544083	HINKES - NO. 41A-1023	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	10	52	N	73	W	PS	131,358	0
532328	HINKES - NO. 12C-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	11	52	N	73	W	PS	151,696	350,683
532332	HINKES - NO. 14C-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	11	52	N	73	W	PS	465,563	1,108,712
532532	HINKES - NO. 23WA-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	11	52	N	73	W	PS	419,186	671,789
532644	HALL - NO. 41C-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	11	52	N	73	W	SI	286,929	295,445
532662	TWENTY MILE - NO. 44C-1123	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SE	1/4	Sec	11	52	N	73	W	PS	250,401	1,051,565

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532663	HALL - NO. 32C-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	11	52	N	73	W	SI	252,465	428,059
532664	HINKES - NO. 21C-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	11	52	N	73	W	PS	331,721	461,004
538696	TWENTY MILE - NO. 34C-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	11	52	N	73	W	SI	38,118	425,846
542579	HALL - NO. 41A-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	11	52	N	73	W	SI	15,446	44,693
542658	TWENTY MILE - NO. 43A-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	11	52	N	73	W	PS	36,848	246,325
543134	HINKES - NO. 14A-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	11	52	N	73	W	SI	106,482	65,673
543139	HINKES - NO. 12A-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	11	52	N	73	W	SI	50,364	170,258
544024	HALL - NO. 32WA-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	11	52	N	73	W	PS	87,627	154,202
544030	TWENTY MILE - NO. 43WA-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	11	52	N	73	W	SI	18,651	234,048
544035	TWENTY MILE - NO. 34WA-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	11	52	N	73	W	SI	2,422	369,985
544054	HINKES - NO. 21WA-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	11	52	N	73	W	SI	0	0
544084	HALL - NO. 32A-1123	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	11	52	N	73	W	PS	9,574	762,794
544098	HINKES - NO. 23A-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	11	52	N	73	W	PS	46,278	289,553
544100	TWENTY MILE - NO. 43C-1123	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	11	52	N	73	W	PS	14,522	14,718
532404	COOK - NO. 14C-1223	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	12	52	N	73	W	PS	229,509	48,617
532405	COOK - NO. 13C-1223	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	12	52	N	73	W	PS	356,804	421,483
532407	COOK - NO. 11C-1223	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	12	52	N	73	W	PS	464,210	464,994

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532408	COOK - NO. 12C-1223	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	12	52	N	73	W	PS	188,036	121,678
532417	COOK - NO. 21C-1223	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	12	52	N	73	W	PS	168,554	66,851
532418	COOK - NO. 22C-1223	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	12	52	N	73	W	PS	375,724	414,300
532420	COOK - NO. 24C-1223	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	12	52	N	73	W	PS	277,086	229,700
532421	COOK - NO. 31W-1223	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	12	52	N	73	W	SI	45,024	205,746
532423	COOK - NO. 33C-1223	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	12	52	N	73	W	PS	192,944	269,057
532424	COOK - NO. 34C-1223	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	12	52	N	73	W	PS	119,996	45,491
532425	COOK - NO. 41C-1223	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	12	52	N	73	W	PS	34,679	163,774
532428	COOK - NO. 44C-1223	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	12	52	N	73	W	SI	500	35,738
542577	COOK - NO. 12A-1223	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	12	52	N	73	W	PS	114,881	45,612
542578	COOK - NO. 14A-1223	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	12	52	N	73	W	PS	154,272	253,940
544954	COOK - NO. 23A-1223R	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	12	52	N	73	W	PS	24,053	501,863
547796	COOK - NO. 12W-1223	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	12	52	N	73	W	PS	3,335	39,556
548356	COOK - NO. 34A-1223	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	12	52	N	73	W	SI	0	327,378
548360	COOK - NO. 21A1-1223	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	12	52	N	73	W	SI	2,074	6,626
531992	OEDEKOVEN - NO. 44C-1323	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	13	52	N	73	W	PS	105,599	600,376
532077	OEDEKOVEN - NO. 23C-1323	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	13	52	N	73	W	PS	173,923	485,734
532078	OEDEKOVEN - NO. 34C-1323	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	13	52	N	73	W	PS	52,048	864,161
532088	COOK - NO. 31C-1323	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NE	1/4	Sec	13	52	N	73	W	SI	134,079	108,504
532186	COOK - NO. 42C-1323	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	13	52	N	73	W	SI	651	651,193
532262	OEDEKOVEN - NO. 24C-1323	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	13	52	N	73	W	SI	170,891	518,836
532661	COOK - NO. 11C-1323	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NW	1/4	Sec	13	52	N	73	W	PS	289,721	178,635

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532734	COOK - NO. 22C-1323	REDSTONE RESOURCES INC	SE	1/4	NW	1/4	Sec	13	52	N	73	W	SI	3,281	19,455
543132	COOK - NO. 41A-1323	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	13	52	N	73	W	SI	0	0
543133	COOK - NO. 32A-1323	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	13	52	N	73	W	PS	32,018	339
543135	OEDEKOVEN - NO. 23A-1323	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	13	52	N	73	W	PS	96,921	24,940
543145	OEDEKOVEN - NO. 34A-1323	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	13	52	N	73	W	PS	92,029	5
535595	TWENTY MILE - NO. 14C-1423	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	14	52	N	73	W	PS	194,384	584,948
538618	HUSKINSON - NO. 34WA-1423	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	14	52	N	73	W	SI	104,499	364,942
538838	TWENTY MILE - NO. 32WA-1423	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	14	52	N	73	W	SI	83,546	470,314
539441	TWENTY MILE - NO. 12C2-1423	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	14	52	N	73	W	PS	60,724	0
532187	TWENTY MILE - NO. 41C-1523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	15	52	N	73	W	PS	372,652	1,459,850
535098	TWENTY MILE - NO. 43C-1523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	15	52	N	73	W	SI	264,387	314,467
535100	TWENTY MILE - NO. 32C-1523	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	15	52	N	73	W	PS	196,639	881,752
544022	TWENTY MILE - NO. 34A-1523	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	15	52	N	73	W	SI	96,819	27,989
544074	TWENTY MILE - NO. 43A-1523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	15	52	N	73	W	PS	108,433	31,468
544075	TWENTY MILE - NO. 41A-1523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	15	52	N	73	W	PS	162,333	82,419
544076	TWENTY MILE - NO. 32A-2223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NE	1/4	Sec	22	52	N	73	W	PS	283,506	27,926
544077	TWENTY MILE - NO. 41A-2223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	22	52	N	73	W	PS	234,920	58,657

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
536562	TWENTY MILE FEDERAL - NO. 34C-2223	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	22	52	N	73	W	PS	77,651	250,842
536565	TWENTY MILE FED - NO. 43C-2223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	22	52	N	73	W	PS	243,147	206,462
535096	TWENTY MILE - NO. 41C-2223	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	22	52	N	73	W	PS	390,982	819,043
532657	TRITON - NO. 42C-2323	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	23	52	N	73	W	PS	370,104	252,779
535597	TRITON - NO. 43C-2323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	23	52	N	73	W	PS	152,550	25,511
536248	MOREL - NO. 41C-2323	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	23	52	N	73	W	PS	72,690	6,062
536561	TWENTY MILE FEDERAL - NO. 14C-2323	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	23	52	N	73	W	PS	73,670	293,972
543661	TWENTY MILE - NO. 21C-2323	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	23	52	N	73	W	PS	112,476	335,780
551906	MOREL - NO. 41A-2323	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	23	52	N	73	W	PS	9,931	0
536247	MOREL - NO. 12C-2423	BLACKSTONE OPERATING INC	SW	1/4	NW	1/4	Sec	24	52	N	73	W	SI	137,368	437,140
531501	TRITON - NO. 44EC-2423	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	24	52	N	73	W	PS	186,047	324,422
531502	OEDEKOVEN - NO. 34C-2423	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	24	52	N	73	W	PS	200,502	241,257
531804	OEDEKOVEN - NO. 42C-2423	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	24	52	N	73	W	PS	111,618	406,599
531805	OEDEKOVEN - NO. 33EC	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	24	52	N	73	W	SI	10,886	46,986
531822	OEDEKOVEN - NO. 41C-2423	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	24	52	N	73	W	PS	44,675	693,047
532079	OEDEKOVEN - NO. 21C-2423	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	24	52	N	73	W	PS	336,353	389,630
532213	OEDEKOVEN - NO. 23C-2423	BLACKSTONE OPERATING INC	NE	1/4	SW	1/4	Sec	24	52	N	73	W	PS	287,348	674,762
532293	OEDEKOVEN - NO. 43C2-24	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	24	52	N	73	W	PS	704	3,420

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
535598	TRITON - NO. 14C-2423	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	24	52	N	73	W	SI	64,017	348,396
532660	OEDEKOVEN - NO. 43C3-2423	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	24	52	N	73	W	PS	146,013	355,466
532395	OEDEKOVEN - NO. 31C-2423	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	24	52	N	73	W	PS	72,483	785,499
532769	OEDEKOVEN - NO. 33C2-2423	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	24	52	N	73	W	PS	202,124	202,178
534701	TRITON - NO. 11A-2523	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	NW	1/4	Sec	25	52	N	73	W	SI	8,865	254,744
534707	COLEMAN - NO. 13A-2523	REDSTONE RESOURCES INC	NW	1/4	SW	1/4	Sec	25	52	N	73	W	SI	0	0
534708	HOLDEN - NO. 14C-2523	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	25	52	N	73	W	PS	106,197	32,728
535009	WAARE - NO. 12C-2523	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	25	52	N	73	W	PS	91,265	162,299
532101	TRITON - NO. 32C-2523	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	25	52	N	73	W	SI	105	3,737
532188	TRITON - NO. 21C-2523	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	25	52	N	73	W	SI	198,386	607,101
531752	TRITON - NO. 44C-2523	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	25	52	N	73	W	SI	98,987	1,014
531753	TRITON - NO. 41C-2523	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	25	52	N	73	W	PS	138,165	319,676
531801	TRITON - NO. 22A-2523	REDSTONE RESOURCES INC	SE	1/4	NW	1/4	Sec	25	52	N	73	W	SI	0	0
531162	TRITON - NO. 44A-2523	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	25	52	N	73	W	PS	21,324	0
531164	TRITON - NO. 42A-2523	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	25	52	N	73	W	PS	6,269	249,500
531165	TRITON - NO. 33A-2523	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	25	52	N	73	W	PS	39,626	0
531166	TRITON - NO. 43A-2523	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	25	52	N	73	W	PS	212	0
531400	TRITON - NO. 43C-2523	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	25	52	N	73	W	PS	360,486	133,197
551905	20 MILE - NO. 34A-2623	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	26	52	N	73	W	PS	165,900	31,240
548329	TWENTY MILE - NO. 14A-2623	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	26	52	N	73	W	PS	125,042	168,072

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
539496	MOORE - NO. 43A-2623	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SE	1/4	Sec	26	52	N	73	W	PS	162,679	17,196
532090	TRITON - NO. 41C-2623	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NE	1/4	Sec	26	52	N	73	W	SI	0	0
532764	TRITON - NO. 21C-2623	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	26	52	N	73	W	SI	0	0
535025	TWENTY MILE - NO. 14C-2623	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	26	52	N	73	W	PS	972,914	715,822
549398	NORTH KITTY FEDERAL - NO. 44-27B	KENNEDY OIL	SE	1/4	SE	1/4	Sec	27	52	N	73	W	PS	46,543	160,074
549399	NORTH KITTY FEDERAL - NO. 33-27B	KENNEDY OIL	NW	1/4	SE	1/4	Sec	27	52	N	73	W	PS	34,300	58,412
550007	NORTH KITTY FEDERAL - NO. 34-27A	KENNEDY OIL	SW	1/4	SE	1/4	Sec	27	52	N	73	W	PS	143,371	67,181
535599	TWENTY MILE - NO. 23C-3523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	35	52	N	73	W	PS	130,479	809,828
535799	DALY - NO. 33CX-3523	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	35	52	N	73	W	SI	57,575	70,062
534693	DALY - NO. 41C-3523	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	35	52	N	73	W	SI	229,211	162,406
534694	DALY - NO. 34C-3523	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	35	52	N	73	W	SI	67,290	269,424
534695	DALY - NO. 44C-3523	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	35	52	N	73	W	SI	115,276	54,898
534697	DALY - NO. 43C-3523	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	35	52	N	73	W	SI	108,075	34,012
534698	DALY - NO. 32C-3523	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	35	52	N	73	W	PS	166,142	417,887
534699	DALY - NO. 42C-3523	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	35	52	N	73	W	SI	153,985	154,021
534700	DALY - NO. 31C-3523	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	35	52	N	73	W	PS	80,244	782,872
532730	TWENTY MILE - NO. 21C-3523	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	NW	1/4	Sec	35	52	N	73	W	PS	413,875	273,353
535023	TWENTY MILE - NO. 12C-3523	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	NW	1/4	Sec	35	52	N	73	W	PS	546,039	905,190
540284	DALY - NO. 44A-3523	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	35	52	N	73	W	SI	14,701	152,361
540296	DALY - NO. 43A-3523	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	35	52	N	73	W	SI	30,946	147,286

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
540297	DALY - NO. 42A-3523	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	35	52	N	73	W	SI	5,932	89,783
540298	DALY - NO. 41A-3523	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	35	52	N	73	W	SI	19,184	250,509
540299	DALY - NO. 34A-3523	BLACKSTONE OPERATING INC	SW	1/4	SE	1/4	Sec	35	52	N	73	W	SI	60,044	18,154
540300	DALY - NO. 33A-3523	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	35	52	N	73	W	PS	85,057	56,046
540314	DALY - NO. 32A-3523	BLACKSTONE OPERATING INC	SW	1/4	NE	1/4	Sec	35	52	N	73	W	PS	125,372	52,143
540315	DALY - NO. 31A-3523	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	35	52	N	73	W	PS	162,723	23,031
538837	STATE - NO. 41C-3623	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	36	52	N	73	W	PS	36,817	5,260
551904	STATE - NO. 14A-3623	BLACKSTONE OPERATING INC	SW	1/4	SW	1/4	Sec	36	52	N	73	W	PS	27,088	85,400
533471	STATE - NO. 24C-3623	BLACKSTONE OPERATING INC	SE	1/4	SW	1/4	Sec	36	52	N	73	W	PS	181,937	574,462
531499	STATE - NO. 41A-3623	BLACKSTONE OPERATING INC	NE	1/4	NE	1/4	Sec	36	52	N	73	W	PS	22,085	5,089
531588	STATE - NO. 44C-3623	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	36	52	N	73	W	PS	155,320	1,264,619
531589	STATE - NO. 43C-3623	BLACKSTONE OPERATING INC	NE	1/4	SE	1/4	Sec	36	52	N	73	W	SI	205,007	819,875
531590	STATE - NO. 31C-3623	BLACKSTONE OPERATING INC	NW	1/4	NE	1/4	Sec	36	52	N	73	W	PS	351,141	278,375
531591	STATE - NO. 13C-3623	BLACKSTONE OPERATING INC	NW	1/4	SW	1/4	Sec	36	52	N	73	W	PS	446,507	927,324
531611	STATE - NO. 22EC-3623	BLACKSTONE OPERATING INC	SE	1/4	NW	1/4	Sec	36	52	N	73	W	PS	396,163	532,462
532260	STATE - NO. 21C-3623	BLACKSTONE OPERATING INC	NE	1/4	NW	1/4	Sec	36	52	N	73	W	PS	401,687	418,518
531802	STATE - NO. 11C-36	BLACKSTONE OPERATING INC	NW	1/4	NW	1/4	Sec	36	52	N	73	W	PS	359,877	441,239
531803	STATE - NO. 33C-3623	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	36	52	N	73	W	PS	404,811	996,721
531848	STATE - NO. 42C-3623	BLACKSTONE OPERATING INC	SE	1/4	NE	1/4	Sec	36	52	N	73	W	PS	252,778	518,696
531882	LYNDE - NO. 24C2-3032	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SW	1/4	Sec	30	53	N	72	W	PS	120,194	143,336
533407	LYNDE - NO. 14C-3032	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SW	1/4	Sec	30	53	N	72	W	PS	186,225	98,363
533416	LYNDE - NO. 23C-3032	DEVON ENERGY PRODUCTION COMPANY LP	NE	1/4	SW	1/4	Sec	30	53	N	72	W	PS	187,940	147,821
532960	HALL REDERAL - NO. 24C-2533	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SW	1/4	Sec	25	53	N	73	W	PS	7,298	0

API Number	Well Name	Company	Location										WOGCC Status	Gas MCF	Water BBLS
532091	LYNDE - NO. 44C-2533	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SE	1/4	Sec	25	53	N	73	W	PS	109,943	193,334
534846	LYNDE - NO. 34C-2533	DEVON ENERGY PRODUCTION COMPANY LP	SW	1/4	SE	1/4	Sec	25	53	N	73	W	PS	189,204	294,417
532984	HALL FEDERAL - NO. 33C-3533	DEVON ENERGY PRODUCTION COMPANY LP	NW	1/4	SE	1/4	Sec	35	53	N	73	W	PS	98,818	63,594
534795	HALL - NO. 44C-3533	DEVON ENERGY PRODUCTION COMPANY LP	SE	1/4	SE	1/4	Sec	35	53	N	73	W	PS	294,826	355,220
533908	STATE - NO. 44C-3633	BLACKSTONE OPERATING INC	SE	1/4	SE	1/4	Sec	36	53	N	73	W	PS	146,003	205,267
533910	STATE - NO. 33C-3633	BLACKSTONE OPERATING INC	NW	1/4	SE	1/4	Sec	36	53	N	73	W	PS	176,078	220,717

API = American petroleum institute; WOGCC = Wyoming Oil and Gas Conservation Commission; mcf = thousand cubic feet; bbls = barrels; PS = pumping submersible; SI = shut-in; PG = producing gas well; FL = flowing

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APPENDIX F

AIR QUALITY TECHNICAL SUPPORT DOCUMENT

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APPENDIX F: AIR QUALITY TECHNICAL SUPPORT DOCUMENT

Introduction

As part of the leasing and permitting process for the Hay Creek II lease by application (LBA) tract, the Buckskin Mine contracted with IML Air Science, a division of Inter-Mountain Laboratories, Inc., to assess potential air quality impacts from mining the proposed tract or an alternative tract configuration within the general analysis area. A portion of the information in this air quality appendix is taken from the Air Quality Technical Support Document (McVehil-Monnett Associates, Inc. 2007) prepared for the West Antelope II Coal Lease Application Environmental Impact Statement (EIS). This information has been updated to current conditions by Inter-Mountain Labs, Inc.

The purpose of this appendix is to provide background information on air quality issues, including the regulatory framework, regional air quality conditions, dispersion model methodologies, and the best available control technology (BACT) process. The actual analyses of known and potential impacts under various alternatives considered in the Hay Creek II LBA EIS appear in section 3.4 of that document. The information presented in the EIS and this technical support document is focused primarily on impacts from emission sources at the Buckskin Mine, the applicant in the EIS. Emissions from neighboring mines are accounted for in the regional monitoring and near-field dispersion modeling discussions. Analysis methods used in preparing this Air Quality Technical Support Document meet or exceed the BLM's "Data Adequacy Standards for the Powder River Coal Region" (BLM 1987) and include use of recent and extensive air quality modeling analyses conducted at the Buckskin Mine by IML Air Science for recent permitting actions.

Regulatory Background

Ambient air quality and air pollution emissions are regulated under federal and state laws and regulations. The Wyoming Department of Environmental Quality/Air Quality Division (WDEQ/AQD) is responsible for managing air quality through the Wyoming Air Quality Standards and Regulations and the Wyoming State Implementation Plan. The WDEQ/AQD has also been delegated authority by the U.S. Environmental Protection Agency (EPA) to implement federal programs of the Clean Air Act Amendments of 1990.

The WDEQ/AQD implements the Wyoming Air Quality Standards and Regulations and Clean Air Act Amendments through various air permitting programs. A proponent initiating a project must undergo new source review and obtain a pre-construction permit or a permit waiver authorizing construction of the project. This process ensures that the project will comply with the air quality requirements at the time of construction. To ensure ongoing compliance, the WDEQ/AQD also implements an operating permit program that can require ongoing monitoring of emissions sources and/or source control systems.

National Ambient Air Quality Standards

The Clean Air Act (CAA) requires the EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. These standards define the maximum level of air pollution allowed in the ambient air. The CAA established NAAQS for six pollutants, known as "criteria" pollutants, which "... cause or contribute to air pollution which may be reasonably anticipated to endanger public health or welfare and the presence of which in the ambient air results from numerous or diverse mobile or stationary sources." The six, present-day criteria pollutants are lead, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3) and particulate matter (PM_{10} and $PM_{2.5}$), where PM_{10} is coarse particulate with mean aerodynamic diameters less than 10 microns and $PM_{2.5}$ is fine particulate with a diameter of 2.5 microns or less.

The CAA and Clean Air Act Amendments allow states to promulgate additional ambient air standards that are at least as stringent, or more stringent, than the NAAQS. The NAAQS and Wyoming Ambient Air Quality Standards (WAAQS), set by the WDEQ/AQD, are listed in table F-1. In some instances, the Wyoming standards are more stringent than the national standards.

During the new source review process, applicants must demonstrate that the facility will not cause or significantly contribute to exceedance of these standards. These demonstrations are made via atmospheric dispersion modeling or other means, including monitoring data approved by the WDEQ/AQD administrator.

The federal standard for particulate matter pollutant was specified as total suspended particles (TSP) until 1987. This measurement included all particulates generally less than 100 microns in diameter. In 1987, the form of the federal standard was changed from TSP to PM_{10} to better reflect human health effects. Wyoming added the PM_{10} standard in 1989, but also retained the TSP standard until March 2000. In 1997, the EPA set separate standards for fine particles ($PM_{2.5}$), based on their link to serious health problems. The EPA adopted an interim $PM_{2.5}$ standard in April 2005, and that standard was later modified in September 2006. That year , the EPA again revised the air quality standards for particulate matter by tightening the 24-hour $PM_{2.5}$ standard from the previous level of 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and revoking the annual PM_{10} standard of 50 $\mu g/m^3$. The EPA retained the existing annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and the 24-hour PM_{10} standard of 150 $\mu g/m^3$. These revisions took effect on December 18, 2006. In view of the December 2006 revisions to the NAAQS for particulate matter, the State of Wyoming entered into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. The current Wyoming and federal ambient air standards for PM_{10} and $PM_{2.5}$ are shown in table F-1. The old TSP standard has not been part of Wyoming's monitoring requirements for more than 10 years. The $PM_{2.5}$ standard is not currently applied to modeling of surface mine emissions. Therefore, any discussion of particulate modeling in Wyoming is confined to PM_{10} emissions. Even with the evolution of state or federal small size particulate standards, TSP is still monitored in some PRB locations.

Attainment/Non-Attainment Area Designations

Pursuant to the CAA, the EPA has developed a method for classifying existing air quality in distinct geographic regions known as air basins, or air quality control regions, and/or metropolitan statistical areas. For each federal criteria pollutant, each air basin (or portion of a basin or statistical area) is classified as in "attainment" if the area has "attained" compliance with the adopted NAAQS for that pollutant, or is classified as in "non-attainment" if the levels of ambient air pollution exceed the NAAQS for that pollutant. Areas for which sufficient ambient monitoring data are not available to define attainment status are designated as "unclassified" for those particular pollutants.

States use the EPA method to designate areas within their borders as being in "attainment" or "non-attainment" with the NAAQS. Most of the Wyoming PRB, including the general analysis area, is designated an attainment area for all pollutants. However, the town of Sheridan, Wyoming, located in Sheridan County about 100 miles northwest of the general analysis area, is a moderate non-attainment area for PM_{10} due to localized sources and activity. No other non-attainment areas are within 150 miles of the general analysis area.

Table F-1. Six Criteria Air Pollutant Concentrations and Applicable Standards in the Powder River Basin (μg/m³)

Criteria Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments	PSD Class II Increments
CO	1-hour	3,336[4]	40,000	40,000	40,000	—	—
	8-hour	1,381	10,000	10,000	10,000	—	—
NO_2	Annual	5[5]	100	100	100	2.5	25
O_3	8-hour	70[6]	147	147	147	—	—
SO_2	3-hour	181[7]	—	1,300	1,300	25	512
	24-hour	62[7]	365	—	260	5	91
	Annual	13[7]	80	—	60	2	20
PM_{10}[8]	24-hour	54[9]	150	150	150	8	30
	Annual	13[9]	—	—	50	4	17
$PM_{2.5}$[8]	24-hour	13[10]	35	35	65	—	—
	Annual	4[10]	15	15	15	—	—

μg/m³ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; WAAQS = Wyoming Ambient Air Quality Standards; PSD = Prevention of Significant Deterioration increment values; CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; SO_2 = sulfur dioxide; PM_{10} = particulate matter measuring 10 microns or less in diameter; $PM_{2.5}$ = particulate matter measuring 2.5 microns or less in diameter.

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.

3 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

4 Data collected by Amoco at Ryckman Creek for an 8-month period during 1978–1979, summarized in Riley Ridge EIS (BLM 1983).

5 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002.

6 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002–2004 (8-hour 4th high).

7 Data collected by Black Hills Power & Light at Wygen 2, Campbell County, Wyoming in 2002.

8 On October 17, 2006, the EPA published final revisions to the NAAQS for particulate matter that took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 μg/m³ and revokes the annual PM_{10} standard of 50 μg/m³. The State of Wyoming entered into rulemaking to revise the WAAQS.

9 Data collected at the Eagle Butte Mine, Campbell County, Wyoming in 2002.

10 Data collected at the Buckskin Mine 2002.

Source: BLM 2005a and WDEQ/AQD 2002 annual report for each mine, unless otherwise noted above.

Prevention of Significant Deterioration

Under requirements of the CAA, the EPA has established prevention of significant deterioration (PSD) rules, intended to prevent deterioration of air quality in attainment and unclassifiable areas. Increases in ambient concentrations of NO_2, SO_2, and PM_{10} are limited to modest increments above the existing or "baseline" air quality in most attainment areas of the country (Class II areas discussed below), and to very small incremental increases in pristine attainment areas (Class I areas discussed below).

For the purposes of PSD, the EPA has categorized each attainment area in the U.S. into one of three area classifications. PSD Class I is the most restrictive air quality category, and was created by Congress to prevent further deterioration of air quality in national and international parks, national memorial parks and national wilderness areas of a given size threshold which were in existence prior to 1977, when the CAA was enacted, or those additional areas which have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II areas, which allow a relatively greater deterioration of air quality over that in existence in 1977, although still within the NAAQS. No Class III areas, which would allow further degradation, have been designated.

The federal land managers have also identified certain federal assets with Class II status as "sensitive" Class II areas for which air quality and/or visibility are valued resources.

The closest Class I area to the general analysis area is Wind Cave National Park in South Dakota, located about 123 miles east of the site. The next closest Class I area is the Badlands Wilderness Area, located about 165 miles to the east-southeast. The closest sensitive areas are the Class II Devils Tower National Monument, the Class II Cloud Peak Wilderness Area and the designated Class I Northern Cheyenne Indian Reservation (in Montana), which are approximately 42, 81, and 74 miles from the general analysis area, respectively. PSD regulations limit the maximum allowable increase (increment) in ambient PM_{10} in a Class I airshed resulting from major stationary sources or major modifications to 4 $\mu g/m^3$ (annual geometric mean) and 8 $\mu g/m^3$ (24-hour average). Increases in other criteria pollutants are similarly limited. Specific types of facilities listed in the PSD rules which emit, or have the potential to emit, 100 tons per year or more of PM_{10} or other criteria air pollutants, or any other facility which emits, or has the potential to emit, 250 tons per year or more of PM_{10} or other criteria air pollutants, are considered major stationary sources and must demonstrate compliance with those incremental standards during the new source permitting process. Fugitive emissions are not counted against the PSD major source applicability threshold unless the source is so designated by federal rule (40 CFR 52.21). As a result, the surface coal mines in the PRB have not been subject to permitting under the PSD regulations because the mine emissions that are subject to PSD applicability levels fall below these thresholds.

Best Available Control Technology

All sources being permitted in Wyoming must meet state-specific BACT requirements, regardless of whether the source is subject to state/federal PSD review. During new source review, a BACT analysis is developed for the proposed project. The BACT analysis must evaluate all control options on the basis of technical, economic, and environmental feasibility. BACT for mining operations in the PRB is largely dictated by categorical control requirements defined in the WAQSR. BACT decisions are mandated through the new source review pre-construction permit.

New Source Performance Standards

The New Source Performance Standards are a program of "end-of-stack" technology-based controls/approaches required by the CAA and adopted by reference into the WAQSR. These standards, which apply to specific types of new, modified or reconstructed stationary sources, require the sources to achieve some base level of emissions control. For surface coal mining in the PRB, this includes certain activities at coal preparation plants. Specifically, the applicable requirements can be found at 40 CFR Part 60, Subpart Y (Standards of Performance for Coal Preparation Plants), and in the WAQSR. However, these standards are typically less stringent than state-level BACT limits.

Federal Operating Permit Program

The Clean Air Act Amendments require the establishment of a facility-wide permitting program for larger sources of pollution. This program, known as the Federal Operating Permit Program, or Title V, requires that major sources of air pollutants obtain a federal operating permit. Under this program, a "major source" is a facility that has the potential to emit more than 100 tons per year of any regulated pollutant, 10 tons per year of any single hazardous air pollutant, or 25 tons per year or more of any combination of hazardous air pollutants, from applicable sources. The operating permit is a compilation of all applicable air quality requirements for a facility and requires an ongoing demonstration of compliance through testing, monitoring, reporting and recordkeeping requirements. Under its proposed permit application, the Buckskin Mine's relevant potential to emit PM_{10} would be 15.8 tons per year, well below the 100 tons per year threshold. Fugitive emissions at coal mines do not contribute to the Title V applicability determination.

Summary of Pre-Construction Permitting Procedures

The WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category. A new coal mine, or a modification to an existing mine, must be permitted by WDEQ/AQD, pursuant to the provisions of WAQSR Chapter 6, Section 2. Under these provisions, a successful permittee must demonstrate that it will comply with all applicable aspects of the WAQSR including state and federal ambient air standards.

When a permittee decides to construct a new surface coal mine or modify operations at an existing surface coal mine that will cause an increase in pollutant emissions, they must submit an application, which is reviewed by WDEQ/AQD new source review staff and the applicable WDEQ/AQD field office. Typically, a company will meet with the WDEQ/AQD prior to submitting an application to determine issues and details that need to be included in the application. A surface coal mining application will include the standard application, BACT measures that will be implemented, an inventory of point and fugitive sources for the mine in question as well as neighboring mines and other sources, and air quality modeling analyses addressing cumulative impacts in the mining region.

The BACT must be employed at all sources permitted/exempted in Wyoming. Per WAQSR Chapter 6, Section 2, BACT at large mining operations typically include but are not be limited to: paving of access roads, treating of haul routes with chemical dust suppressant (and water), and storage of large amounts of materials/coal awaiting shipment in enclosures such as silos, troughs or barns. These and other mitigation measures are considered in the development of emission inventories used for modeling/permitting.

For the modeling analyses, an applicant must compile an emission inventory of PM_{10} from their mining operation, neighboring mines, and other surrounding sources. For PM_{10} from the applicant mine, both point source and fugitive dust emissions are quantified. The emissions are based on the facility's potential to emit in each year of the life of the mine. The applicant also examines the surrounding coal mining operations and their most recent air quality permits to determine their emissions throughout the life of the mine. Two or more worst-case years (generally with the highest potential emissions) are then modeled in detail for ambient air quality impacts. Other surrounding emission sources may also be considered in the modeling analysis. The model years used for this analysis were 2011 and 2012. More information about modeling conducted at the Buckskin Mine and the neighboring northern group of mines is provided in attachment A to this appendix.

Long-term PM_{10} modeling is conducted for the permit application to demonstrate compliance with the annual PM_{10} standard. For the point and area sources, the Industrial Source Complex Long Term model, version 3 (ISCLT3), is typically used.

The WDEQ/AQD has recently required all mines in the PRB to "submit and justify a background PM_{10} concentration with each permit application" (WDEQ/AQD 2006). A site specific PM_{10} background concentration of 12 $\mu g/m^3$ was developed in the modeling analysis and submitted to the WDEQ/AQD for approval in March 2006, prior to submitting the Application to Modify the Buckskin Mine. With WDEQ/AQD approval, the PM_{10} modeling results were added to this background and compared to the annual standard. Likewise, compliance with the annual NO_2 standard was verified using ISCLT3 and added to the WDEQ/AQD-approved NO_2 background concentration.

Short-term PM_{10} modeling is not required by WDEQ/AQD, nor does the agency consider it to be an accurate representation of short-term impacts. Section 234 of the Clean Air Act Amendments mandates the administrator of the EPA to analyze the accuracy of short-term modeling of

fugitive particulate emissions from surface coal mines. A June 26, 1996 letter from EPA Region VIII to Wyoming State Representative Ms. Barbara Cubin, details the results of an EPA study wherein the short-term model failed to meet evaluation criteria and tended to significantly overpredict 24-hour impacts of surface coal mines. The memorandum of agreement of January 24, 1994 between EPA Region VIII and the State of Wyoming allows WDEQ/AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This agreement remains in effect and ambient particulate monitoring is required of each coal mine through conditions of their respective permits. The 1994 Memorandum of Agreement also requires WDEQ/AQD to implement "Best Available Work Practice" mitigation measures at any mine where an exceedance of the PM_{10} air quality standard has occurred (Federal Register: September 12, 1995,Volume 60, Number 176).

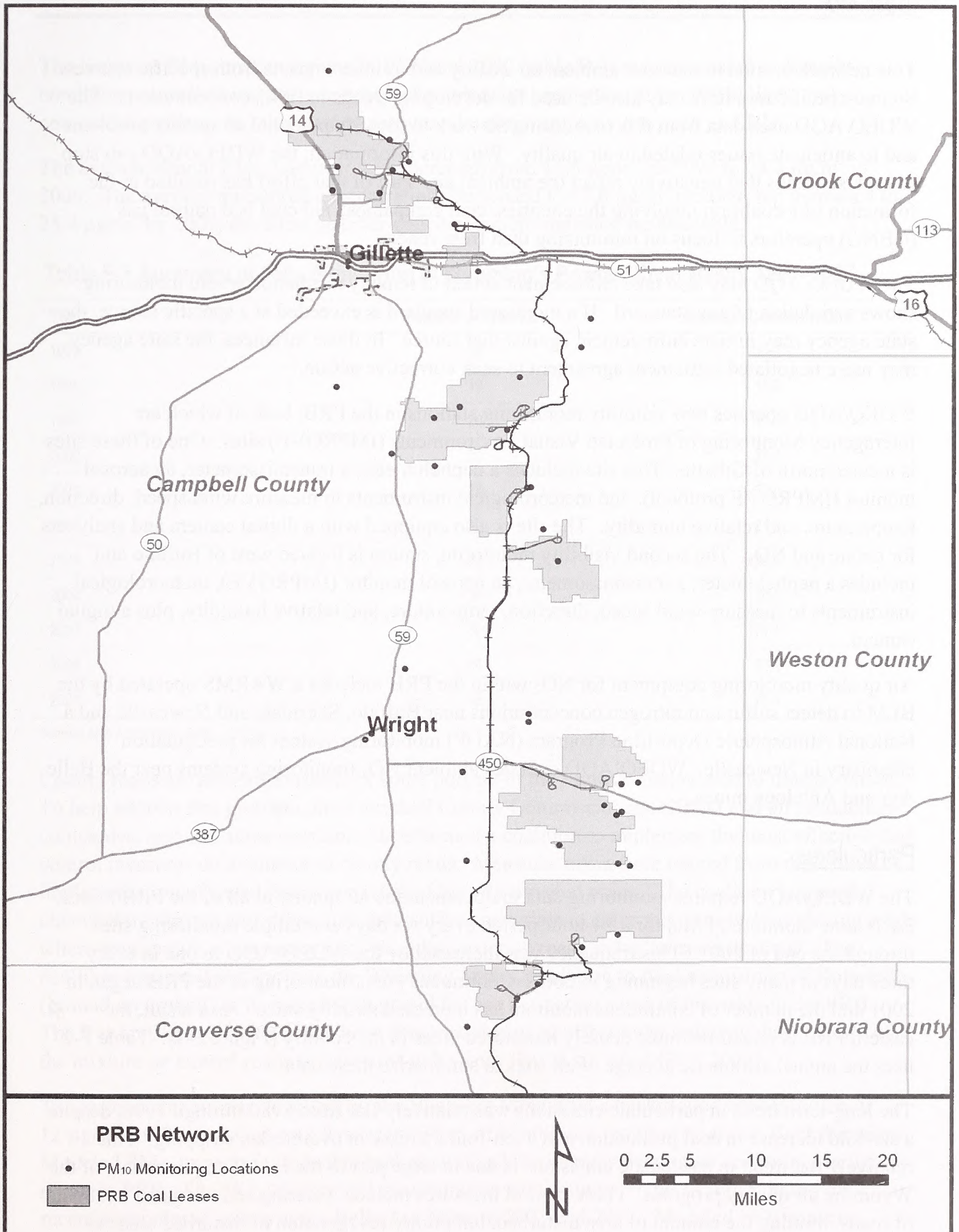
The permit application is reviewed by WDEQ/AQD to determine compliance with all applicable air quality standards and regulations. This includes review of compliance with emission limitations established by New Source Performance Standards, review of compliance with ambient standards through modeling analyses, and establishment of control measures to meet BACT requirements. The WDEQ/AQD proposed permit conditions are sent to public notice for a 30-day review period, after which a final decision on the permit is made (or a public hearing is held prior to a final permit decision).

The Buckskin Mine has prepared permit applications and conducted air quality modeling analyses (Attachment A) when mine plan changes have dictated and as required by WDEQ/AQD. These applications and analyses demonstrate that mining operations have complied, and will continue to comply, with all applicable aspects of the WAQSR and the Clean Air Act Amendments.

Coal mines in the PRB are also required to quantify nitrogen oxides (NO_x) emissions from their operations. Dispersion modeling is required to demonstrate compliance with the ambient NO_2 standard. Potential emissions from diesel powered mining equipment, blasting, and locomotive emissions (on mine property) are considered in the modeling analyses. In a fashion similar to the PM_{10} analysis, neighboring mining operations and other surrounding sources are also included in the NO_x /NO_2 analysis. Regional NO_x sources generally include power plants, natural gas compressor stations, paved highways, long-haul railroad lines, and municipalities.

Existing Air Quality

WDEQ/AQD monitors air quality through an extensive network of air quality monitors throughout the state. The eastern portion of the PRB has an extensive network of PM_{10} monitors operated by the mining industry due to the density of coal mines in the region (Figure F-1). Monitors are also located in Sheridan, Gillette, Arvada, and Wright, Wyoming.



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Figure F-1

Active PM_{10} Monitoring Stations in Northeastern Wyoming

This network is sited to measure ambient air quality and to infer impacts from specific sources. Source-specific monitors may also be used for developing trends in PM_{10} concentrations. The WDEQ/AQD uses data from this monitoring network to identify potential air quality problems and to anticipate issues related to air quality. With this information, the WDEQ/AQD can stop or reverse trends that negatively affect the ambient air. Part of that effort has resulted in the formation of a coalition involving the counties, coal companies, and coal bed natural gas (CBNG) operators to focus on minimizing dust from roads.

The WDEQ/AQD may also take enforcement action to remedy a situation where monitoring shows a violation of any standard. If a monitored standard is exceeded at a specific source, the state agency may initiate enforcement against that source. In those instances, the state agency may use a negotiated settlement agreement to seek corrective action.

WDEQ/AQD operates two visibility monitoring stations in the PRB, both of which are Interagency Monitoring of Protected Visual Environments (IMPROVE) sites. One of these sites is located north of Gillette. This site includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), and meteorological instruments to measure wind speed, direction, temperature, and relative humidity. The site is also equipped with a digital camera and analyzers for ozone and NO_x. The second visibility monitoring station is located west of Buffalo and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE), meteorological instruments to measure wind speed, direction, temperature, and relative humidity, plus a digital camera.

Air quality monitoring equipment for NO_2 within the PRB includes a WARMS operated by the BLM to detect sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle and a National Atmospheric Deposition Program (NADP) monitoring system for precipitation chemistry in Newcastle. WDEQ/AQD operates ambient NO_x monitoring systems near the Belle Ayr and Antelope mines.

Particulates

The WDEQ/AQD requires monitoring data to document the air quality at all of the PRB mines. Each mine monitored PM_{10} for a 24-hour period every six days at multiple monitoring sites through the end of 2001. This frequency was increased by the WDEQ/AQD to one in every three days at many sites beginning in 2002. Continuous PM_{10} monitoring in the PRB began in 2001 and the number of continuous monitors has increased steadily since. As a result, the eastern PRB is one of the most densely monitored areas in the country (Figure F-1). Table F-2 uses the annual arithmetic average of all sites to summarize these data.

The long-term trend in particulate emissions was relatively flat from 1980 through 1998, despite a six-fold increase in coal production and a ten-fold increase in overburden stripping. This relatively flat trend in particulate emissions is due in large part to the BACT requirements of the Wyoming air quality program. These control measures include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetation of disturbed areas to reduce wind erosion, and expedited final reclamation.

The increases PM_{10} concentrations in 1999 and 2000 (table F-2) may be related to drought conditions as well as increases in coal and overburden production at the PRB mines, and coincident increases in other natural resource development activities such as CBNG.

The average annual PM_{10} concentration increased from 15.3 $\mu g/m^3$ in 1997 to 24.4 $\mu g/m^3$ in 2000. The average monitored concentrations decreased to 19.6 $\mu g/m^3$ in 2004, but increased to 25.4 $\mu g/m^3$ by 2007, the latest year for which complete statistics are available.

Table F-2. Summary of PM_{10} Monitoring in Wyoming's Powder River Basin, 1997–2007

Year	Number of Monitors	Average Concentration
1997	18	15.3
1998	19	15.8
1999	20	21.4
2000	23	24.4
2001	28	23.4
2002	32	21.9
2003	34	20.8
2004	36	19.6
2005	36	21.1
2006	36	23.9
2007	35	25.4

Source: EPA AirExplorer, 2009

County roads are also responsible for some portion of the fugitive dust related to transportation. To help address this problem, the Campbell County Commissioners, CBNG and oil production companies, and coal mine operators have formed a coalition to implement the most effective dust control measures on a number of county roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads. The coalition has used chemical treatments and alternative road surface materials to control dust as well as closing roads where appropriate or necessary and rebuilding existing roads to higher specifications. The coalition requested money from the Wyoming State Legislature to fund acquisition of Rotomill (ground up asphalt) to be mixed with gravel for use in treating some of the roads in the PRB. The Rotomill/gravel mixture has been demonstrated to be effective in reducing dust; the life of the mixture on treated roads is estimated to be from five to six years (Bott 2006).

The most recent air permit action for the Buckskin Mine used a background concentration of 12 $\mu g/m^3$ for PM_{10}, based on a five-year history of continuous monitoring at two Buckskin sites. Modeled PM_{10} impacts include this background and the impacts from other coal mines in the northern PRB. The NO_2 background concentration was assumed to be 14 $\mu g/m^3$ based on recently monitored values at the Belle Ayr Mine in 2001 and 2002. Modeled NO_2 impacts

include this background and the impacts from regional sources such as other coal mines in the northern PRB, natural gas compressors, power plants, railroads, highways and urban sources.

In 2006, the Buckskin Mine submitted detailed modeling analyses to the WDEQ/AQD in support of a request for a permit modification, which addressed the impacts associated with a proposed production increase to its current permitted level of 42 million tons per year and proposed improvements to mine facilities. These analyses considered all emissions sources and included the neighboring Eagle Butte, Rawhide, Dry Fork, Wyodak and Fort Union mines. The WDEQ/AQD approved the mine modification in Permit MD-1379, issued January 17, 2007.

Nitrogen Dioxide

Annual mean NO_2 concentrations have been periodically measured in the PRB since 1975. The annual mean NO_2 concentrations recorded by those monitoring efforts have all been well below the 100 $\mu g/m^3$ standard. The highest annual mean concentration recorded to date was 22 $\mu g/m^3$ at two separate sites between March 1996 and April 1997.

NO_2 is a product of incomplete combustion at sources such as gasoline- and diesel-burning engines or from mine blasting activities. Incomplete combustion during blasting may be caused by wet conditions, fractured geological formations, deformation of bore holes, and other factors. Generally, blasting-related NO_x emissions are more prevalent at operations that use the blasting technique referred to as cast blasting (Chancellor pers. comm.). Cast blasting refers to a type of direct blasting in which the blast is designed to cast the overburden from on top of the coal into the previously mined area. The Buckskin mine does not use this technique and does not anticipate doing so in the future. The higher strip ratios at Buckskin do not lend themselves to dragline excavation, with which cast blasting is commonly associated.

Mining sources of NO_x were modeled as fugitive emissions from the areas where mining activities were projected to occur. These included overburden and coal blasting emissions, tailpipe emissions from mobile equipment, and locomotive tailpipe emissions from the Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union and Wyodak mines. Stationary equipment tailpipe emissions from Buckskin were also modeled. NO_x emissions from blasting were estimated using emission factors provided from EPA guidance document AP-42, Section 13.3, "Explosives Detonation." EPA emission factors were also used for NO_x emissions from tailpipes and locomotives (EPA 2009).

In the mid-to late-1990s, OSM received complaints from several citizens about NO_2 emissions from blasting (particularly cast blasts) from several mines in the PRB. The EPA expressed concerns that NO_2 levels in some of those blasting clouds may have been sufficiently high at times to cause human health effects. The WDEQ/AQD also had general concerns about levels of NOx from all types of development in the PRB. In response to those concerns, the coal mining industry instituted a monitoring network in cooperation with the WDEQ/AQD to gather data on NOx emissions beginning in 2001. Additional monitoring was conducted throughout the PRB from 2003 to 2006. Coal mines in the PRB, including the Buckskin Mine, have voluntarily

modified their blasting techniques; the WDEQ/AQD has imposed additional blasting restrictions at a limited number of mines (excluding Buckskin). More information about these studies and restrictions is presented in the following discussion.

On the order of the Director of the WDEQ, members of the mining industry in the PRB conducted a comprehensive, multi-year monitoring and modeling study of NO_2 exposures from blast clouds. The study was conducted at the Black Thunder Mine in the southern PRB, which is one of the largest surface coal mines in the nation. Results of the study (Thunder Basin Coal Company 2002), conducted pursuant to protocols reviewed and approved by the WDEQ/AQD, were provided to the agency and the public in July 2002.

Using a combination of NO_2 measurements collected near 91 blast sites (78 valid runs) and a conservative modeling/extrapolation approach, the authors developed a series of "safe" setback curves for coal, overburden, and cast shots for various wind speed classes. The curves were derived from the sampled data, conservative projections of concentrations at greater/lesser distances than measured, and an assumed safe level (based on a comprehensive review of available health effects data) of 5.0 parts per million for 10 minutes.

Subsequently, the data in the 2002 report were augmented with monitored data/analyses from an additional 45 validated blast events at the Eagle Butte, North Antelope Rochelle, Buckskin, and Cordero-Rojo mines. New curves were developed, based on the entire basin-wide data set, encompassing 123 valid tests, but they differed only slightly from the original Black Thunder curves.

Other regional sources of NO_x are also modeled. These included power plants (Neil Simpson I and II, Wygen I, II, and III, Wyodak, Two Elk, and Dry Fork Station), gas compressor stations, railroads, highways and the City of Gillette. The KFx coal upgrading facility was also modeled. Emission factors and rates for these regional sources were provided by the WDEQ/AQD. Highways, railroads and urban areas were modeled as area sources, while the power plants, compressor stations and KFx were treated as point sources.

Individual and combined impacts from Buckskin, the other northern mines, and regional sources were evaluated at all model receptors. These receptors were placed around the perimeter of the North Area mines and outward in a rectangular grid with 500-meter spacing. The extent of the receptor grid was sufficient to encompass the area of significant NO_x impact from the Buckskin Mine (1.0 $\mu g/m^3$ or more). NO_2 impacts were derived by multiplying modeled NO_x concentrations by 75% (per Section 6.2.3 of EPA's Guideline on Air Quality Models, Appendix W to 40 CFR Part 51) and adding a background NO_2 concentration of 14 $\mu g/m^3$. This background was based on WDEQ/AQD guidance and ambient NO_x monitoring results at Foundation Coal's Belle Ayr Mine in 2001 and 2002.

Sources of fugitive NO_x emissions at the Buckskin Mines include overburden removal and coal blasting events, tailpipe emissions from the mining equipment, and emissions from the trains used to haul the coal from the mine. The mine does not have any point sources for NO_x.

NO_x modeling was conducted in support of the Buckskin Mining Company's June 2006 air permit application. Similar in scope to the PM_{10} analysis, emissions from Buckskin, neighboring mines and other regional sources were modeled for the two worst-case years of 2011 and 2012.

Maximum annual NO_2 impacts (including regional sources and background concentration) at any model receptor of 38.0 $\mu g/m^3$ and 37.8 $\mu g/m^3$ were predicted in 2011 and 2012 respectively, as compared to the annual NO_2 NAAQS of 100 $\mu g/m^3$. At the model receptor where these maximum values occurred, Buckskin's contributions were 1.6 $\mu g/m^3$ in 2011 and 1.8 $\mu g/m^3$ in 2012. This receptor is in an area impacted primarily by neighboring mines.

Ozone

O_3 has the same chemical structure whether it occurs miles above the earth or at ground-level and can be "good" or "bad," depending on its location in the atmosphere. In the earth's lower atmosphere, ground-level O_3 is considered "bad." Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_x and VOC that help form O_3. Ground-level O_3 is the primary constituent of smog. Sunlight and hot weather cause ground-level O_3 to form in harmful concentrations in the air. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of "bad" O_3, but even rural areas are also subject to increased O_3 levels because wind carries O_3 and pollutants that form it hundreds of miles away from their original sources.

Under the Clean Air Act, EPA has set protective health-based standards for O_3 in the air we breathe. Prior to May 27, 2008, the NAAQ 8-hour standard for O_3 was 0.080 parts per million (157 $\mu g/m^3$). On March 27, 2008 (effective May 27, 2008) the EPA revised the 8-hour standard to 0.075 parts per million (147 $\mu g/m^3$). Ozone monitoring is not required by the WDEQ/AQD at the Buckskin Mine but levels have been monitored at WDEQ/AQD operated and maintained ambient air quality monitor sites in the PRB since 2001. An exceedance of the O_3 8-hour standard occurs if the 4th-highest daily maximum value is above the level of the standard (0.08 parts per million prior to 2008 and 0.075 parts per million since 2008).

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ATTACHMENT A – AIR QUALITY MODELING SUMMARY

for **Bureau of Land Management**

BLM Wyoming State Office
Casper Field Office
Casper, Wyoming

Air Quality Modeling Summary
Buckskin Mine Permit MD-1513

April 2009 *by IML Air Science*

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1.0 Introduction

In June 2006, IML Air Science. (IML) submitted a modeling study to the Wyoming Department of Environmental Quality, Air Quality Division (AQD) on behalf of the Buckskin Coal Company (BCC). This study was performed in support of a BCC permit application to increase annual coal production at the Buckskin Mine from 27.5 MMTPY to 42 MMTPY and to install a new truck dump, primary and secondary crusher, conveyor, transfer tower and coal silo to accommodate this increase. Based on the modeling and permit application, Permit MD-1513 was subsequently issued on January 17, 2007 by the AQD. This document summarizes the modeling process and results from that study, as referenced in the Hay Creek II Environmental Impact Study.

Since mine plan changes were necessitated by this coal production increase, the goal of this modeling study was to demonstrate that the proposed changes would not prevent the attainment or maintenance of the PM_{10} and NO_2 air quality standards in Wyoming. To that end, air quality modeling in Wyoming consists of the following steps:

- Development of an updated mine plan to account for the coal production increase
- Generating an updated list of equipment required to achieve the production increase
- Determination of "open acreage" requirements
- Determination of BACT for qualifying fugitive and point sources
- Determination of miscellaneous emission control practices
- Development of emission inventories and "worst-case" year determination
- Determination of background PM_{10} and NO_2 concentrations
- Model selection, execution and results

The following sections describe this process for the Buckskin Mine in greater detail.

2.1 Mine Plan

BCC's Buckskin Mine is an existing multiple-pit surface coal mine that utilizes traditional truck and shovel techniques to mine coal. To account for the proposed production increase, BCC developed an updated topsoil stripping, coal mining and reclamation sequence, which would allow for coal extraction at the Buckskin Mine through the year 2018. This mine plan was finalized and subsequently submitted to IML for use in the model.

2.2 Mine Equipment List

BCC developed an inventory of mine equipment required to attain the proposed production increase. This inventory varies from year to year depending on haul distance, overburden thickness, and other factors. The percentage of larger equipment generally increases through time as older, smaller equipment is retired. Accompanying the production increase, BCC was to install a second truck dump, primary crusher, conveyor system, secondary crusher, and transfer tower, along with an additional coal storage silo. This information was submitted to IML for use in the model.

2.3 Open Acreage

Permitting requirements established by AQD in 2002 include a discussion of open acreage potentially subject to wind erosion. More specifically, the requirement is to discuss, summarize, and map the land status for the current year and for the years modeled. This is similar to a Wyoming Department of Environmental Quality, Land Quality Division (LQD) annual report requirement. Some of the information used in the model was obtained from the annual report to LQD for the 2005 reporting year, which represented the "current year" for the application.

BCC projected the amount of open acreage for the modeled years of 2011 and 2012, based on the current open acreage and the revised topsoil stripping and reclamation sequence. These figures provided the "disturbed acres" subject to wind erosion in each of the modeled years' emission inventories.

2.4 BACT

For this modeling study, a Best Available Control Technology (BACT) analysis was performed by IML to take into account control measures, such as chemical applications to roads, enclosing silos, bins and other storage areas and treatment of active work areas. These active work areas include those for scrapers, blasting, overburden/coal loading areas, coal dumping, haul road repair and areas susceptible to wind erosion. Once these control measures were determined, they were used in the development of the emission inventory.

2.5 Miscellaneous Emission Control Practices

Other control practices contained in the emission inventory include a coal fire mitigation program and a haul road dust suppression program. Both of these programs act to minimize fugitive emissions at the mine.

2.6 Emission Inventory Development and Worst-Case Year Selection

Fugitive and point source emission inventories for PM_{10} and NO_x were developed for the Buckskin Mine based on site-specific information provided by the mine. Fugitive and point source emissions for PM_{10} and NO_x from nearby mines (Rawhide, Eagle Butte, Dry Fork, Wyodak and Fort Union Mines) were also developed from current permit information. The resultant particulate emission inventories were used to determine the years that would be modeled.

Projections of future mine-wide emissions from Buckskin and other regional sources were based on methodologies prescribed by the AQD. Specifically, those methodologies were discussed with AQD staff in a pre-application conference on December 20, 2005. Subsequently, it was decided to use the most recent Memorandum, *PRB Coal Mine Permitting Guidance*, issued by WDEQ-AQD on February 27, 2006 (WDEQ-AQD, 2006a). This memo forms the primary basis for how the permitting analysis was performed. To supplement mine emission sources in the regional NO_x modeling, AQD provided an updated inventory of NO_X emissions from regional sources. These sources included coal bed methane (CBM) compressor stations, power plants, railroads, highways and urban sources.

2.6.1 Fugitive and Point Source PM_{10} Emission Inventory

BCC provided life-of-mine (LOM) coal production, overburden handling and related operational parameters needed for emission inventory development for the 42 MMTPY mine plan evaluated for this study. The parameters were used in conjunction with a set of emission factors endorsed by the AQD (WDEQ-AQD, 1979) and EPA's AP-42 to calculate annual emissions of PM_{10} and NO_x from each emission-producing activity. Note that the AQD emission factors calculate TSP

emissions, which are then multiplied by AQD's factor of 0.30 to arrive at the PM_{10} emission factors.

The Buckskin coal preparation and processing facilities include crushers, material transfers and loadouts. All existing point sources at the coal preparation facilities are outfitted with either baghouses or Passive Enclosure Systems (PECS). The PECS eliminate the points' potential to emit fugitive emissions. Such controls are deemed by WDEQ-AQD to be zero emitters.

2.6.2 Mobile and Stationary Source PM_{10} Emission Inventory

Mobile PM_{10} emission sources at the Buckskin Mine include scrapers, haul trucks, graders, dozers, water trucks, support vehicles, locomotives, drills and loaders. Emissions were calculated using AQD emission factors for all sources except locomotives, where the exhaust emission factor was calculated from EPA's AP-42 mobile source guidance.

PM_{10} emissions from stationary diesel engines were calculated using operating hours from calendar year 2005 as a baseline, with appropriate increases to reflect a maximum coal production level of 42 million tons per year. These engines include light plants, compressors, pumps, welders and generators.

2.6.2 Mobile and Fugitive Source NO_x Emission Inventory

Emission sources included in this inventory are the exhaust from mobile source mining equipment such as scrapers, haul trucks, graders, dozers, water trucks and locomotives, and fugitive sources such as overburden and coal blasting events. Mobile source (tailpipe) NO_x emissions were calculated using estimated operating hours necessary to mine coal at the future projected production rate and EPA approved mobile source emission factors. NO_x emissions from blasting were calculated using estimated explosive usage necessary to mine coal at the future projected rate and an EPA approved emission factor.

2.6.2 Stationary Engine NO_x Emission Inventory

NO_x emissions from stationary engines were calculated using actual operating hours from calendar year 2005 as a baseline, with appropriate increases to reflect a maximum coal

production level of 42 million tons per year. The emission factor for stationary engines came from EPA's AP-42.

2.7 Regional Source Emission Inventories

The following neighboring mines in the Nouth Group were included in the PM_{10} modeling analysis: Eagle Butte, Rawhide, Dry Fork, Wyodak and Fort Union. These mines, plus regional sources provided by AQD (regional power plants and point sources, CBM sources, mainline trains, urban areas, and road emissions), were considered in the NO_x analysis. All regional NO_x sources and emissions were obtained in accordance with methodologies approved by AQD.

2.7.1 Railroad, Road, Power Plant, Urban, Coal Bed Methane and Regional Point Sources

The information for railroads, highways, power plants, urban areas, and regional point sources was provided by AQD on May 5, 2005. These sources generally fell within a 40 km by 60 km screening area prescribed by AQD for the regional NO_x analysis. Power plants included Two Elk Power Plant (slightly outside the screening area), Neil Simpson I and II Power Plants, Wyodak Power Plant, WYGEN Unit I Power Plant and two power plants with air quality permit applications under review by AQD at the time of Buckskin's submittal. These two, the Dry Fork Station and WYGEN Unit II were included at the advice of AQD. The sole urban source included in the modeling analysis was the town of Gillette. The KFx coal upgrading facility was also included in the analysis. Other point sources included compressor stations supporting oil/gas/CBM activities. Only NO_x emissions were considered from these sources and no scale-up factors were used at the instructions of AQD.

2.8 Selection of Worst-Case Years

AQD policy requires that the maximum PM_{10} and NO_x impacts (during the life-of-mine) from all mine sources be identified and compared to the applicable air quality standards. Because it is not practical to model all of the years in the life-of-mine, years with maximum annual emissions from mining operations are determined and then modeled. Model results for these "worst-case" emission years are then compared to the applicable ambient air quality standards. If the

maximum impact is below the air quality standard, it can be assumed that the standard will be achieved throughout the LOM.

Based on Buckskin Mine and regional emission inventories, LOM years 2011 and 2012 were chosen as worst-cases to be modeled. Year 2012 was selected primarily because it represents the highest annual PM_{10} emission year for the Buckskin Mine (1,180 tons/year); 2011 represents the highest annual PM_{10} emissions for all North Group mines combined.

These model years are also among the worst-case for Buckskin NO_x emissions, with 2012 having the highest annual emissions (1,689 tons/year), and 2011 having the third highest annual emissions (1,625 tons/year). Year 2011 also has the highest NO_x emission total for the North Group mines. Therefore, the selection of these worst-case years will also provide the maximum potential NO_x impacts on the Nouth Group modeling area.

2.9 Dispersion Modeling Methodology

Cumulative PM_{10} impacts from Buckskin Mine and neighboring mines were modeled using the Industrial Source Complex Long-Term (ISCLT3) Model. PM_{10} impacts were modeled for all facilities for the two worst-case years, and concentrations were calculated at receptors located along the Lands Necessary to Conduct Mining (LNCM) boundaries for the North Group mines. The cumulative PM_{10} concentrations at each receptor location were compared to the Wyoming and Federal annual ambient air quality standard of 50 $\mu g/m^3$ to determine compliance with that standard.

NO_2 impacts from Buckskin and neighboring sources were also modeled for the two worst-case years. However, an initial model run was first performed for each worst-case year to determine the significant impact area ($\geq 1 \mu g/m^3$ annual average NO_x impact) produced on a regional receptor grid from sources within the Buckskin Mine only. Then, additional model runs for each worst-case year considered all sources from the area mines, as well as the regional sources, to determine cumulative NO_2 impacts at receptors within the significant impact area. The cumulative NO_2 concentrations were compared to the Wyoming and Federal ambient air quality standard of 100 $\mu g/m^3$ to determine compliance. Emissions were modeled as NO_x, and the final

concentrations were multiplied by 0.75 to account for chemical conversion to NO_2. The 0.75 factor is in accordance with Section 6.2.3 of EPA's Guideline on Air Quality Models (40 CFR Part 51, Appendix W).

2.9.1 Dispersion Model

The Industrial Source Complex Long-Term (ISCLT3) Model was used to model annual average PM_{10} and NO_2 concentrations from both fugitive emission sources and point sources per AQD directive (WDEQ-AQD, 2006a). The latest version of ISCLT3 was downloaded from EPA's Support Center for Regulatory Models. The number of sources and receptors was expanded to 2,000 and 10,000 respectively, and the model was recompiled. ISCLT3 was run in regulatory default mode with rural dispersion parameters. In addition, the model was run using elevations for all point sources and receptors. Elevations were determined from USGS 7.5-minute digital elevation models (DEM's).

2.9.2 Terrain Data

The DEM's, all source locations, and receptor locations for each worst-case year were used as inputs into the EPA's terrain processor, AERMAP. AERMAP uses the input data to extract elevations in meters for all sources and receptors. These elevations were then used in each respective ISCLT3 input file.

2.9.3 Meteorological Data

Hourly on-site meteorological data collected at the Eagle Butte Mine were used in this modeling analysis. AQD provided IML with the Eagle Butte six-year (1995 – 2000) Joint Frequency Distribution (JFD) of wind speed, wind direction, and atmospheric stability class. Annual average temperatures were taken from values recorded from 1925 to 2001 at the Gillette National Weather Service meteorological station. Atmospheric mixing heights were provided by AQD.

2.9.4 Receptors

For PM_{10} modeling, receptors were placed along the LNCM boundaries for the Buckskin, Dry Fork, Eagle Butte, Rawhide, Fort Union and Wyodak Mines with a spacing of 500 meters. The AQD "Mine A/Mine B" policy for cumulative impacts applied to this analysis because the

Rawhide and Buckskin mines have LNCM boundaries that overlap. Receptors were placed on these overlapping LNCM boundaries to model the impact of Buckskin PM_{10} emissions on Rawhide Mine's overlapping boundary. Following the WDEQ-AQD Mine A/Mine B policy, the receptors from overlapping boundaries were not included in the top ten receptor concentrations.

Compliance and significant impact receptor networks were created for the NOx modeling analysis. The significant impact receptor network comprised a rectangular grid 33 by 54 kilometers on 500-meter spacing. This proved sufficiently large to encompass modeled significant impacts (greater than or equal to 1 $\mu g/m^3$) from Buckskin Mine for years 2011 and 2012. The NO_2 compliance receptor network included the North Group Mine LNCM boundary receptors in addition to a rectangular grid receptor network fully containing the Buckskin-related NO_x significant impact isopleths (1 µg/m3) for years 2011 and 2012. This network extended 28 km in the east-west direction and 50 km in the north-south direction. All NO_2 modeling receptors were spaced at 500-meter intervals.

2.9.5 Emission Apportioning

Fugitive PM_{10} and NO_x emissions for each of the worst-case years were apportioned into area sources based on the activity type and location. The number and location of the area sources, as well as their dimensions and orientation, were based on the pit configuration and road orientation provided in the mining progression map. Emissions were divided by the area of each area source in which they occurred to arrive at an emission rate in grams/second/square meter. NO_x emissions for the regional roads and mainline trains were also apportioned into area sources.

2.9.6 Point Source Modeling Parameters

Prior to this permit application, Buckskin Mine reduced the number of point sources of PM_{10} emissions by converting all but four baghouses at their coal preparation facilities to PECS. PECS is considered a zero emission technologyl, effectively eliminating emissions from all but four point sources at Buckskin. Point source parameters from North Group mines were used in the model as identified in each mine's most recent permit.

2.9.7 PM_{10} and NO_2 Background Concentration

For both PM_{10} and NO_2, background concentrations were added to the predicted annual average concentrations at each model receptor to yield total ambient concentrations. The levels of these background concentrations were developed in consultation with the Air Quality Division. The AQD has required all mines in the PRB to "submit and justify a background PM_{10} concentration with each permit application" (WDEQ-AQD, 2006a). Buckskin Mine submitted such an analysis to the AQD on March 20, 2006. Hourly data from the Buckskin meteorological station and two continuous particulate monitoring stations were studied to determine PM_{10} concentrations in ambient air not impacted by the Buckskin mining operation. Four years worth of data were used (2002 through 2005). Approximately 60,000 hourly average PM_{10} concentrations were compiled and correlated with wind directions spanning the southwest and northwest quadrants, the most likely sources of background air. As expected, each of the two particulate monitors demonstrated minimum ambient PM_{10} concentrations during periods when the wind was blowing toward the center of Buckskin mining activity. The study produced a site-specific PM_{10} background concentration of 12 $\mu g/m^3$. This level was approved by the AQD prior to submittal of the permit Application in June, 2006.

A background nitrogen dioxide (NO_2) concentration of 14 µg/m3 was obtained through ambient monitoring conducted in 2001 and 2002 at the Foundation Coal Belle Ayr Mine. The NO_2 background concentration has been revised from the previous value of 20 $\mu g/m^3$, which was obtained from pre-construction monitoring conducted for the 1978-79 Wyodak project. The AQD considers the more recent Belle Ayr Mine NO_2 data to be a more accurate representation of background NO_2 concentrations due to the larger amount of data collected and tighter quality assurance procedures placed on that data. The background value of 14 $\mu g/m^3$ represented the highest annual average (from Belle Ayr Mine in both 2001 and 2002) taken from the four NO_2 monitors located in the area of coal bed methane activity.

2.10 Modeling Results

2.10.1 PM_{10} Modeling Analysis and Results

The PM_{10} area source and point source characteristics for Buckskin Mine and the North Group mines were input into ISCLT3 for each worst-case year. The LNCM receptors and local meteorological parameters were also input to the model. The site-specific background

concentration of 12 μg/m^3 was added to the results from the model to obtain the total impact from the fugitive and point sources.

All model results from the Buckskin Mine impact analysis show concentrations, after adding background, below the Federal and Wyoming annual PM_{10} air quality standard of 50 μg/m^3. The maximum cumulative concentration predicted in 2011 was 40.3 μg/m^3 (including 12.0 μg/m^3 background) and occurred along the Eagle Butte LNCM. For year 2012, the maximum predicted cumulative concentration of 40.6 μg/m^3 (including background) also occurred along the Eagle Butte LNCM. Note that in 2012 sources within the Buckskin Mine contributed only 0.59 μg/m^3 to this maximum cumulative concentration.

2.10.2 NO_2 Modeling Analysis and Results

Buckskin mine emission sources were modeled for each worst-case year in order to determine the extent of the annual average 1 μg/m^3 contour defining the significant impact area. Receptors within the significant impact areas were then modeled to determine compliance with the ambient air standard in the cumulative impact modeling assessment, as discussed below.

The area source and point source NO_x information for Buckskin and other North Group mines were input into ISCLT3 for each worst-case year along with the significant impact area receptor grid and JFD. Annual NO_x emissions from other regional sources were also input into the model. Emissions were modeled as NO_x, with the resulting concentrations multiplied by 0.75 to account for chemical conversion to NO_2. The AQD-specified background concentration of 14 μg/m^3 NO_2 was then added to the model results to obtain the total impact.

The Wyoming and Federal annual NO_2 air quality standard, to which the model results are compared, is 100 μg/m^3. All model results for the Buckskin impact analysis show concentration predictions well below this value.

The maximum cumulative concentration predicted in 2011 was 38.0 μg/m^3 (including background) and occurred along the Eagle Butte boundary. Buckskin's contribution to this highest concentration was 1.61 μg/m^3. For 2012, the maximum predicted cumulative

concentration was 37.8 $\mu g/m^3$ (including background) and also occurred along the Eagle Butte LNCM boundary. Buckskin's contribution to this highest concentration was 1.79 $\mu g/m^3$.

2.10.3 Short-term Particulates

AQD does not require modeling of fugitive dust emissions to predict compliance with the 24-hour PM_{10} standard (which is 150 $\mu g/m^3$, not to be exceeded more than one time per year). Neither EPA nor the AQD have been able to demonstrate that available modeling tools and emission factors are adequate for this task. Section 234 of the 1990 Clean Air Act Amendments required EPA to demonstrate that it had adequate modeling tools before the agency could require states to employ 24-hour modeling at surface coal mines. To date, that demonstration has not been made.

Instead, it has been AQD's position that ambient air monitoring data collected by the mines demonstrate that compliance with short-term ambient standards can be achieved when a mine employs BACT. A memorandum of agreement dated January 24, 1994 between EPA and the state of Wyoming allows AQD to use particulate monitoring in lieu of short-term modeling to assess 24-hour compliance and to predict short-term ambient impacts from mining. In 2002 AQD also began requiring a demonstration that "…mining operations will not cause or contribute to ambient violations…" (WDEQ-AQD, 2006a). The following discussion is a demonstration that Buckskin will not cause or contribute to a 24-hour PM_{10} ambient air violation in the area of the North Group.

2.10.4.1 Historical Ambient Air Quality

2.10.4.2 Buckskin Mine

Ambient PM_{10} concentrations are monitored at two locations at the Buckskin Mine. These locations are identified as the West Teom and North Teom sites. Each site is equipped with a low-volume Rupprecht & Patashnick Tapered Element Oscillating Microbalance (TEOM) PM_{10} continuous monitor. The monitors meet the US EPA Automated Equivalency Method (EQSA-0495-100). The particulate and meteorological monitoring network is operated in accordance with Buckskin Mine Quality Assurance Project Plan (QAPP) approved in August 2008. Both monitors record hourly average and 24-hour average PM_{10} concentrations, with the latter being

reported to AQD quarterly. The highest yearly second-high 24-hour PM_{10} concentration at the Buckskin Mine was 139 $\mu g/m^3$, which occurred at the West Teom site in 2003.

While none of the annual second-high PM_{10} concentrations at the Buckskin Mine has ever been over the 24-hour standard of 150 $\mu g/m^3$, during the last six years three of the monitored first-high concentrations have exceeded this 24-hour standard. The first exceedance occurred at the North Teom site on August 16, 2002 and resulted in a maximum 24-hr PM_{10} concentration of 181.7 $\mu g/m^3$. This exceedance correlated with strong winds and was judged an "exceptional event" by the AQD. A second exceedance occurred at the West Teom site on December 27, 2003 and resulted in a maximum 24-hr concentration of 202.4 $\mu g/m^3$. The third exceedance occurred at the West Teom site on March 27, 2007, resulting in a maximum 24-hr concentration of 244.0 $\mu g/m^3$. WDEQ-AQD deemed the 2007 exceedance an "exceptional event," as provided for by the recently implemented Natural Events Action Policy (NEAP). Winds on that day averaged over 33 mph with a peak hourly average of 42 mph. Buckskin followed all mitigation and documentation procedures as required by the NEAP. In all three cases detailed reports of the exceedance and accompanying meteorological conditions were submitted to WDEQ-AQD.

2.10.4.3 North Group Mines (Rawhide, Eagle Butte, Dry Fork Wyodak and Fort Union)

The northern mines consist of five mines in addition to Buckskin: Dry Fork Mine, Eagle Butte Mine, Fort Union Mine, Rawhide Mine, and Wyodak Mine. All of the mines, with the exception of Fort Union, operate in accordance with a Quality Assurance Project Plan specific to each mine. The Fort Union mine has not been in operation for the last several years. Besides Buckskin, the four other active mines in the North Group currently operate a total of 9 PM_{10} monitors. Among these mines the 24-hr PM_{10} NAAQS of 150 $\mu g/m^3$ was exceeded three times. The Wyodak mine recorded a value of 165 $\mu g/m^3$ in 2005. In 2007 the Rawhide and Eagle Butte mines recorded 178 $\mu g/m^3$ and 168 $\mu g/m^3$ respectively. All three values were deemed "Exceptional Events" by WDEQ, due to high winds.

2.10.4.4 Compliance Demonstration

Under the revised mining operation modeled in this application, the Buckskin Mine will not

cause or contribute to a violation of the 24-hour ambient air standard. The following points form the reasoning for this conclusion.

- By virtue of monitored concentrations collected at the Buckskin Mine over the past three years, it is clear that mining activities at the Buckskin Mine do not cause or significantly contribute to violations of the 24-hour ambient air standard. The maximum highest second-high 24-hour PM_{10} concentration monitored at the Buckskin Mine during the past three years was below the standard at 107 $\mu g/m^3$, and the average of the highest second-high concentrations was 75 $\mu g/m^3$. The maximum first-high concentration in 2007 did exceed the standard, but was deemed the result of extremely high winds.
- The replacement of baghouse controls with zero-emission PECS on all but four of the point sources will reduce dust emissions at Buckskin Mine. This will have a beneficial effect on air quality and monitored concentrations.
- Modeling results indicate that it is unlikely that the Buckskin Mine will contribute in the future to a violation of the annual PM_{10}.standard of 50 $\mu g/m^3$. As discussed above, the highest modeled annual concentrations at any of the North Group receptors in 2011 and 2012 were 40.3 and 40.6 $\mu g/m^3$ respectively. For both years, Buckskin's contribution to the highest modeled average concentrations was less than the significant impact threshold of 1 $\mu g/m^3$.
- During the times when mining emissions from the Buckskin Mine blow towards neighboring mines, it is unlikely that such emissions will contribute to a violation because of the nature of the emissions released and the distance that they must travel before impacting an air monitor. Mining emissions are typically low-level releases consisting of particulate matter that is subject to gravitational settling. Emissions from current Buckskin mining operations would have to travel several miles before reaching Rawhide Mine, which is the closest mine to Buckskin. Particulate settling over these distances will minimize possible contributions to violations.

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APPENDIX G

NON-MINE GROUNDWATER AND SURFACE WATER RIGHTS

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APPENDIX G: NON-MINE GROUNDWATER AND SURFACE WATER RIGHTS

Table G-1. Groundwater Rights[1] within 3 Miles of the General Analysis Area

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P78393W	53	72	27	SWSW	STO	JOHN #11	GILBERT OEDEKOVEN	240	180
P4045P	53	72	27	SESW	DOM,STO	HAMPE #2	RENE A. HAMPE	3	0
P86156W	53	72	27	SESW	DOM	HAMPE #1	RENE A. HAMPE	420	235
P4044P	53	72	27	SESW	DOM,STO	HAMPE #1	RENE A. HAMPE	6	0
P115507W	53	72	29	SWSW	STO	STEINER NORTH SPRING	BYRON F/MARJORIE OEDEKOVEN	15	0
P111696W	53	72	30	SWSW	STO,CBNG	Lynde 14C-3032	DEVON ENERGY PRODUCTION CO. L.P.	299	110
P115508W	53	72	31	NWNE	STO	STEINER NW #2E	BYRON F/MARJORIE OEDEKOVEN	210	46
P115517W	53	72	31	NENW	DOM,STO	HOUSE WELL #1	RICHARD M/OR JUDY K LYNDE	360	200
P130428W	53	72	31	SWSE	STO	LANDECK # 8	WILLIAM A. LANDECK	564	260
P77546W	53	72	31	SWSE	STO	LANDECK #12	FRANK LANDECK	280	80
P18184P	53	72	32	SENE	DOM,STO	JOHN #3	GILBERT OEDEKOVEN	220	120
P115506W	53	72	32	SESW	STO	STEINER HAND DUG	BYRON F/MARJORIE OEDEKOVEN	40	35
P115505W	53	72	32	SESW	STO	STEINER YARD #1E	BYRON F/MARJORIE OEDEKOVEN	125	65
P115509W	53	72	32	SESW	STO	STEINER YARD #1W	BYRON F/MARJORIE OEDEKOVEN	65	35
P111927W	53	72	32	SESW	DOM	Oedekoven House Well #1	BYRON F OEDEKOVEN		
P18188P	53	72	32	SWSE	STO	JOHN #7	GILBERT OEDEKOVEN	150	80
P18185P	53	72	33	NENW	STO	JOHN #4	GILBERT OEDEKOVEN	180	90
P27251W	53	72	33	SWNW	DOM,STO	JOHN #8	GILBERT OEDEKOVEN	315	34
P61232W	53	72	33	SWNW	DOM,STO	JOHN #9	GILBERT OEDEKOVEN	800	320
P110932W	53	73	25	SESW	STO,CBNG	Hall Fed 24C-2533	REDSTONE RESOURCES, INC.	368	161
P177784W	53	73	25	SESW	STO,CBNG	HALL FEDERAL 24C-2533	DEVON ENERGY PRODUCTION CO. L.P.	367	312

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P115195W	53	73	25	SWSE	STO,CBNG	LYNDE 34C-2533	DEVON ENERGY PRODUCTION CO. L.P.	416	172
P107671W	53	73	25	SESE	STO,CBNG	LYNDE 44C-2533	DEVON ENERGY PRODUCTION CO. L.P.	341.5	110
P52285W	53	73	25	SESE	STO	BAM 30	RICHARD M/OR JUDY K LYNDE	330	95
P115518W	53	73	25	SESE	STO	WEST PASTURE WELL #1	RICHARD M/OR JUDY K LYNDE	254	110
P110637W	53	73	34	SESE	STO,CBNG	LANDECK 44C-3433	DEVON ENERGY PRODUCTION COMPANY, L.P	795	251
P177793W	53	73	35	SENW	STO,CBNG	HALL FEDERAL 22C-3533	DEVON ENERGY PRODUCTION CO. L.P.	452	196
P110955W	53	73	35	SENW	STO,CBNG	Hall Fed 22C-3533	REDSTONE RESOURCES, INC.	452	196
P110638W	53	73	35	NWSW	STO,CBNG	HALL 13C-3533	REDSTONE RESOURCES, INC.	522	160
P36325W	53	73	35	NWSW	MON	A35 3	GULF MINERAL RESOURCES COMPANY	535	4.6
P177790W	53	73	35	NWSW	STO,CBNG	HALL 13C-3533	DEVON ENERGY PRODUCTION CO. L.P.	522	160
P140606W	53	73	35	SWSW	CBNG	HALL 14W-3533	DEVON ENERGY PRODUCTION CO. L.P.	806	746
P135554W	53	73	35	SWSW	CBNG	HALL 14A-3533	DEVON ENERGY PRODUCTION CO. L.P.	179	170
P177787W	53	73	35	SESW	STO,CBNG	HALL FEDERAL 24C-3533	DEVON ENERGY PRODUCTION CO. L.P.		
P110919W	53	73	35	SESW	STO,CBNG	Hall Fed 24C-3533	Redstone Resources	464	171
P26475W	53	73	35	NESE	MIS	HALL #4	MEADOWLARK FARMS INC.**JOY LUCILLE HALL	660	200
P177792W	53	73	35	NWSE	STO,CBNG	HALL FEDERAL 33C-3533	DEVON ENERGY PRODUCTION CO. L.P.	404	141
P110956W	53	73	35	NWSE	STO,CBNG	Hall Fed 33C-3533	REDSTONE RESOURCES INC.	404	141
P114994W	53	73	35	SESE	STO,CBNG	HALL 44C-3533	DEVON ENERGY PRODUCTION CO. L.P.	389	132
P111707W	53	73	36	NWNE	STO,CBNG	State 31C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	305	105
P111709W	53	73	36	SENE	STO,CBNG	State 42C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	303	128
P111703W	53	73	36	NWNW	STO,CBNG	State 11C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	332	60

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P111705W	53	73	36	SENW	STO,CBNG	State 22C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	406	203
P111704W	53	73	36	NWSW	STO,CBNG	State 13C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	377	79
P3262P	53	73	36	SWSW	STO	#5 HALL	DEAN W. HALL** STATE OF WYOMING	110	70
P111706W	53	73	36	SESW	STO,CBNG	State 24C-3633	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY PRODUCTION CO. L.P.	411	188
P111708W	53	73	36	NWSE	STO,CBNG	State 33C-3633	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC.	385	202
P111701W	53	73	36	SWSE	STO,CBNG	REILE 34LC-3333	DEVON ENERGY PRODUCTION CO. L.P.	468	217
P111687W	53	73	36	SESE	STO,CBNG	State 44C-3633	REDSTONE RESOURCES, INC.	358	198
P25G	52	72	2	NWNE	IND	ADON WATER WELL #1	TEXAS CO.	567	445
P15391W	52	72	3	SWNE	STO	HOLLER #1	D. C. HOLLER		
P18187P	52	72	5	NENE	STO	JOHN #6	GILBERT OEDEKOVEN	140	60
P42484W	52	72	5	NENW	STO	JOHN #10	GILBERT OEDEKOVEN	225	120
P123569W	52	72	6	SWNE	STO,CBNG	Landeck 32C-622	REDSTONE RESOURCES INC.	252	132
P26477W	52	72	6	SWNW	MIS	HALL #6	MEADOWLARK FARMS INC.**JOY LUCILLE HALL	400	140
P109849W	52	72	6	SWNW	STO,CBNG	HALL 12C-622	REDSTONE RESOURCES, INC.	377	189
P109850W	52	72	6	NESW	STO,CBNG	FRANKLIN 23C-622	REDSTONE RESOURCES, INC.	295	143
P106925W	52	72	6	NWSW	STO,MIS,CBNG	HALL 13C-622	REDSTONE RESOURCES, INC	343	172
P110963W	52	72	6	SWSW	STO,CBNG	Franklin 14C-622	REDSTONE RESOURCES, INC.	437	264
P108735W	52	72	6	SESW	STO,CBNG	FRANKLIN 24C-622	REDSTONE RESOURCES, INC	339	163
P113421W	52	72	6	NESE	STO,CBNG	FRANKLIN 43C-622	REDSTONE RESOURCES, INC.	296	270
P110630W	52	72	6	NWSE	STO,CBNG	FRANKLIN 33C-622	REDSTONE RESOURCES, INC.	333	203
P111689W	52	72	6	SWSE	STO,MIS,CBNG	Franklin 34C-622	REDSTONE RESOURCES, INC.	326	224

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P115198W	52	72	6	SESE	STO,CBNG	FRANKLIN 44C-622	REDSTONE RESOURCES, INC.	317	292
P177473W	52	72	6	SESE	STO	FOWLSTON STOCK #1	BYRON F/MARJORIE OEDEKOVEN		
P111690W	52	72	7	NENE	STO,MIS,CBNG	Franklin 41C-722	REDSTONE RESOURCES, INC.	261.5	134
P111691W	52	72	7	SENE	STO,CBNG	Franklin 41C-722	REDSTONE RESOURCES, INC.	284	173
P120886W	52	72	7	NENW	STO,CBNG	Oedekoven 21C-722	Redstone Resources	370	347
P107778W	52	72	7	NWNW	STO,MIS,CBNG	OEDEKOVEN 11C-722	REDSTONE RESOURCES, INC	361	154
P107776W	52	72	7	SENW	STO,CBNG	OEDEKOVEN 22C-722	REDSTONE RESOURCES, INC	365	201
P107777W	52	72	7	NWSW	STO,MIS,CBNG	OEDEKOVEN 13C-722	REDSTONE RESOURCES, INC	299	127
P114989W	52	72	7	SWSW	STO,CBNG	FRANKLIN 14C-722	REDSTONE RESOURCES, INC.	273	213
P108734W	52	72	7	SESW	STO,CBNG	FRANKLIN 24C-722	REDSTONE RESOURCES, INC	265	75
P110631W	52	72	7	NWSE	STO,MIS,CBNG	OEDEKOVEN 33C-722	REDSTONE RESOURCES, INC.	326	162
P115510W	52	72	7	SWSE	STO	PERRY W #1E	BYRON F/MARJORIE OEDEKOVEN	300	75
P115511W	52	72	7	SESE	STO	PERRY E #1W	BYRON F/MARJORIE OEDEKOVEN	42.1	25.1
P119224W	52	72	8	NENW	STO,CBNG	Taylor 21C-822	REDSTONE RESOURCES, INC.	339	280
P119414W	52	72	8	SWNW	STO,CBNG	Taylor 12C-822	Redstone Resources	256	161
P161015W	52	72	8	NESE	CBNG	HALL 43C-822	MAJESTIC PETROLEUM OPERATIONS, LLC	198	115
P103907W	52	72	9	SWNW	STO	912C-C5	CARL/OLA MCGEE	220	84.7
P58643W	52	72	9	NESW	MON	09/11/2005	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P63080W	52	72	9	NWSW	MON	9-12C-C5(1)	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	80	-1
P3186P	52	72	12	NWSW	STO	60 BAR 2	60 BAR RANCH	72	50
P20030P	52	72	13	NWNW	DOM,STO	OFFUTT #1	PAUL AND JANE ROURKE	240	70
P20031P	52	72	14	NWNE	STO	ROURKE #1	PAUL AND JANE ROURKE	90	10
P3185P	52	72	14	SWNE	STO	60 BAR 1	60 BAR RANCH	105	60

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P68803W	52	72	15	NWSW	MIS	GRANT #1	PAUL AND JANE ROURKE		
P52186W	52	72	16	NENE	MON	16 18	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P52184W	52	72	16	NENE	MON	16-1AC4	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	71	28
P52185W	52	72	16	NENE	MON	16-1A-02	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	33	21.5
P157784W	52	72	16	SWNE	STO	ROURKE #1	PAUL D. ROURKE** WY STATE BOARD OF LAND COMMISSIONERS		
P52201W	52	72	16	SWNE	MON	16-7A-C2	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	71	9.4
P62279W	52	72	16	SENE	MON	16-8D-A5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	45	8.16
P157994W	52	72	16	SENE	STO	16-8D-A5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	43.5	8.16
P118037W	52	72	16	SENE	MON	16-8C1-AL2	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	19.4	7.96
P118038W	52	72	16	SENE	MON	16-8C2-AL5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	17.8	7.98
P54140W	52	72	16	NENW	MON	16-30-02	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	128	53.3
P63078W	52	72	16	NENW	MON	16-3B-C5	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	200	-1
P53963W	52	72	16	NENW	MON	16-3A0B	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P52188W	52	72	16	NWNW	MON	16-4B-C4	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	180	132
P54373W	52	72	16	NWNW	MON	16-4B2-C2	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P55770W	52	72	16	SWNW	MON	16-5B-A4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	30	19.2
P54612W	52	72	16	SWNW	MON	16-6B1-5	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	80	1.73
P55771W	52	72	16	SENW	MON	16-6C1-A2	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	25	6.21
P62283W	52	72	16	SENW	MON	16-6C-C5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	53	2.14
P58630W	52	72	16	SENW	MON	16-6C-C5	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P55764W	52	72	16	SENW	MON	16-6C-A4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	21	20
P62282W	52	72	16	SENW	MON	16-6C-02	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	16	5.4
P53227W	52	72	16	NESW	MON	16 - 11A-02	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	140	-1
P58635W	52	72	16	NESW	MON	16-11D1	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	40	-1
P55775W	52	72	16	NESW	MON	16-11B-A4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	29	-1
P58636W	52	72	16	NESW	MON	16-11C1	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	-1	-1
P53836W	52	72	16	NESW	IRR	HAY CREEK #1	WY BOARD OF LAND COMMISSIONERS**JANE OFFUTT ROURKE		
P63079W	52	72	16	NESW	MON	16-11C-C5	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	20	-1
P63075W	52	72	16	NESW	MON	16-11B-A5	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	24.5	0.31
P62274W	52	72	16	NESW	MON	16-11C-S10	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	39.1	5.7

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P63081W	52	72	16	NESW	MON	21-3D-C5	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	222	-1
P63082W	52	72	16	NWSW	MON	16-12B-5(1)	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	37	-1
P58638W	52	72	16	NWSW	MON	16-12D1	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	87	-1
P52208W	52	72	16	SWSW	MON	16-13C-04	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	152	82.2
P62267W	52	72	16	SWSW	MON	16-13C-C5	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	295	151
P63076W	52	72	16	SWSW	MON	DRILL HOLE #1	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	120	-1
P118042W	52	72	16	SWSW	MON	16-13C-C5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	118.6	44.4
P52206W	52	72	16	SWSW	MON	16-13C-C4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	280	152
P54369W	52	72	16	SWSW	MON	16-13C-C4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P63077W	52	72	16	SWSW	MON	DRILL HOLE #2	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	220	-1
P52209W	52	72	16	SESW	MON	16-14A-C4	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	51	
P53961W	52	72	16	SESW	MON	16-14AOB	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P53962W	52	72	16	SESW	MON	16-14ACO	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P62278W	52	72	16	NESE	MON	16-9D-A5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	28.9	10
P52202W	52	72	16	NWSE	MON	16 10D	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P55780W	52	72	16	SESE	MON	16-16B-A4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	14	13.9
P157993W	52	72	16	SESE	STO	16-16C-A5	TRITON COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	24	8.8
P55781W	52	72	16	SESE	MON	16-16C-A4	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	18	8.35
P52210W	52	72	16	SESE	MON	16-16D	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY		
P156876W	52	72	17	SWNW	CBNG	TRITON 12C-1722	MAJESTIC PETROLEUM OPERATIONS, LLC	340	260
P158636W	52	72	17	NWSW	CBNG	TRITION 13C-1722	MAJESTIC PETROLEUM OPERATIONS, LLC	319	245
P156877W	52	72	17	SWSW	CBNG	TRITON 14C-1722	MAJESTIC PETROLEUM OPERATIONS, LLC	273	205
P145709W	52	72	17	NESE	MIS,CBNG,RES	TRITON 43AC-1722	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	166	78
P58647W	52	72	17	NESE	MON	17-9A-A5	WY STATE BOARD OF LAND COMMISSIONERS** TRITON COAL COMPANY	15	4.5
P145708W	52	72	17	SWSE	MIS,CBNG,RES	TRITON 34AC-1722	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	256	129
P145707W	52	72	17	SESE	MIS,CBNG,RES	TRITON 44AC-1722	MAJESTIC PETROLEUM OPERATIONS, LLC** Triton Coal Company	210	117
P110632W	52	72	18	NWNE	STO,CBNG	FRANKLIN 31C-1822	REDSTONE RESOURCES, INC.	270	94.5
P116606W	52	72	18	NENW	STO,CBNG	McGEE 21C-1822	REDSTONE RESOURCES, INC.	271	210
P108733W	52	72	18	NWNW	STO,CBNG	FRANKLIN 11C-1822	REDSTONE RESOURCES, INC	288	105
P115519W	52	72	18	SWNW	STO,CBNG	FRANKLIN 12C-1822	REDSTONE RESOURCES, INC.	325	249
P108732W	52	72	18	SENW	STO,CBNG	FRANKLIN 22C-1822	REDSTONE RESOURCES, INC	296	109
P107779W	52	72	18	NWSW	STO,MIS,CBNG	OEDEKOVEN 13C-1822	REDSTONE RESOURCES, INC	372	172
P108442W	52	72	18	SWSW	STO,CBNG	FRANKLIN 14C-1822	REDSTONE RESOURCES, INC	393	359
P83206W	52	72	18	SWSW	DOM	LAVERNE #1	CECLE L. AND LAVERNE L. COOK	85	55

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P108444W	52	72	18	SESW	STO,CBNG	FRANKLIN 24C-1822	REDSTONE RESOURCES, INC	368	159
P141899W	52	72	18	SESW	STO,CBNG	FRANKLIN 24CR-1822	MAJESTIC PETROLEUM OPERATIONS, LLC	370	298
P108446W	52	72	18	NWSE	STO,CBNG	FRANKLIN 33C-1822	REDSTONE RESOURCES, INC	329	127
P108452W	52	72	19	NWNE	STO,CBNG	FRANKLIN 31C-1922	REDSTONE RESOURCES, INC	452	187
P112364W	52	72	19	SENE	STO,CBNG	Isora CS #4	YATES PETROLEUM CORP.** SMC MINING COMPANY	436	63
P107780W	52	72	cl	NWNW	STO,MIS,CBNG	OEDEKOVEN 11C-1922	REDSTONE RESOURCES, INC	434	197
P102546W	52	72	19	NWSW	STO	OEDEKOVEN #31S-1922	BYRON F OEDEKOVEN	180	30
P61486W	52	72	19	SESE	STO	ODEKOVEN STOCK WELL #1	CHARLES R. OEDEKOVEN	100	10
P145711W	52	72	20	NENE	MIS,CBNG,RES	TRITON 41AC-2022	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	261	165
P63083W	52	72	20	NWNE	MON	20-2C-C5 (PILOT HOLE)	WY BOARD OF LAND COMMISSIONERS**MINING SHELL OIL COMPANY	320	-1
P145710W	52	72	20	NWNE	MIS,CBNG,RES	TRITON 31AC-2022	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	274	162
P145712W	52	72	20	SWNE	MIS,CBNG,RES	TRITON 32AC-2022	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	333	191
P145713W	52	72	20	SENE	MIS,CBNG,RES	TRITON 42AC-2022	Triton Coal Company** MAJESTIC PETROLEUM OPERATIONS, LLC	300	204
P112367W	52	72	20	SWNW	STO,CBNG	Olin CS #2	YATES PETROLEUM CORP.** SMC MINING COMPANY	362	89
P112368W	52	72	20	NWSW	STO,CBNG	Olin CS #3	YATES PETROLEUM CORP.** SMC MINING COMPANY	322	196
P112369W	52	72	20	SWSW	STO,CBNG	Olin CS #4	YATES PETROLEUM CORP.** SMC MINING COMPANY	282	81
P58648W	52	72	21	NENW	MON	21-3-05	WY BOARD OF LAND COMMISSIONERS** SHELL OIL COMPANY	222	-1
P20029P	52	72	23	SESE	STO	CLARK #1	MARY J. CLARK	55	12

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
25/11/152W	52	72	28	SWNW					
25/8/152W	52	72	28	SWNW					
25/10/152W	52	72	28	SWNW					
25/9/152W	52	72	28	SWNW					
P112361W	52	72	29	NENW	STO,CBNG	Isora CS #1	YATES PETROLEUM CORP.** SMC MINING COMPANY	402	50
P112365W	52	72	29	NWNW	STO,CBNG	Isora CS #5	YATES PETROLEUM CORP.** SMC MINING COMPANY	402	112
P112362W	52	72	30	NENE	STO,CBNG	Isora CS #2	YATES PETROLEUM CORP.** SMC MINING COMPANY	449	92
P102867W	52	72	30	SWNE	STO,MIS,CBNG	OEDEKOVEN #32C-3022	REDSTONE RESOURCES, INC	354	201
P109588W	52	72	30	SWNE	STO,CBNG	OEDEKOVEN 32C2-3022	REDSTONE RESOURCES, INC.	363	221
P112363W	52	72	30	SENE	STO,CBNG	Isora CS #3	YATES PETROLEUM CORP.** SMC MINING COMPANY	404	134
P104083W	52	72	30	NENW	STO,MIS,CBNG	TRITON 21C-3022	REDSTONE RESOURCES, INC	436	207
25/1/137W	52	72	30	NWNW					
P104081W	52	72	30	SWNW	STO,MIS,CBNG	TRITON 12C-3022	REDSTONE RESOURCES, INC	404.5	-1
P104082W	52	72	30	NWSW	STO,MIS,CBNG	TRITON 13C-3022	REDSTONE RESOURCES, INC	402	-1
P102867W	52	72	30	SWSW	STO,MIS,CBNG	OEDEKOVEN #32C-3022	REDSTONE RESOURCES, INC	354	201
P104092W	52	72	30	SWSW	STO,MIS,CBNG	TRITON #14C-3022	REDSTONE RESOURCES, INC	361.5	-1
25/8/99W	52	72	30	SWSW					
P104084W	52	72	30	SESW	STO,MIS,CBNG	TRITON 24C-3022	REDSTONE RESOURCES, INC	407	-1
P104080W	52	72	30	NWSE	STO,MIS,CBNG	TRITON 33A-3022	REDSTONE RESOURCES, INC		
P104529W	52	72	31	NENW	STO,MIS,CBNG	TRITON 21C-3122	REDSTONE RESOURCES, INC	356	220
P103485W	52	72	31	NWNW	STO,MIS,CBNG	TRITON #11A-3122	REDSTONE RESOURCES, INC	128	-1

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P104079W	52	72	31	NWNW	STO,MIS,CBNG	TRITON #11C-3122	REDSTONE RESOURCES, INC	371	162
P103183W	52	72	31	SWNW	STO,MIS,CBNG	OEDEKOVEN #12A-3122	REDSTONE RESOURCES, INC	126.5	-1
25/9/123W	52	72	31	SWNW					
25/7/123W	52	72	31	SWNW					
P131330W	52	72	31	SWNW	CBNG	TRITON 12D-3122	REDSTONE RESOURCES INC.	1232	685
25/8/123W	52	72	31	SWNW					
P103613W	52	72	31	SENW	STO,MIS,CBNG	TRITON #22A-3122	REDSTONE RESOURCES, INC	137	-1
P104078W	52	72	31	NESW	STO,MIS,CBNG	TRITON 22C-3122	REDSTONE RESOURCES, INC	345	-1
25/7/87W	52	72	31	NWSW					
25/9/87W	52	72	31	NWSW					
25/6/87W	52	72	31	NWSW					
25/5/87W	52	72	31	NWSW					
P113423W	52	72	31	NWSW	STO,CBNG	TRITON 13D-3122	REDSTONE RESOURCES, INC.	1227	250
25/8/87W	52	72	31	NWSW					
P103618W	52	72	31	NWSW	STO,MIS,CBNG	TRITON #13A-3122	REDSTONE RESOURCES, INC	110.5	-1
P104528W	52	72	31	SWSW	STO,MIS,CBNG	TRITON 14C-3122	REDSTONE RESOURCES, INC	370	0
P104077W	52	72	31	SESW	STO,MIS,CBNG	CABALLO 24C-3122	REDSTONE RESOURCES, INC	1206	-1
25/2/10W	52	72	31	SESW					
P108964W	52	72	31	SESW	STO,MIS,CBNG	MARQUISS 24D-3122	REDSTONE RESOURCES, INC.	1206	160
P103043W	52	72	31	SESW	STO,CBNG	MARQUISS #24A-3122	REDSTONE RESOURCES, INC	92	0
P103045W	52	72	31	SESW	STO,MIS,CBNG	LANDECK #13C-223	REDSTONE RESOURCES, INC		
24/8/151W	52	72	32	SWSE					
24/9/151W	52	72	32	SWSE					
24/12/151W	52	72	32	SWSE					

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
24/7/151W	52	72	32	SWSE					
25/8/64W	52	73	0						
P109851W	52	73	1	NENE	STO,CBNG	HALL 41C-123	REDSTONE RESOURCES, INC.	360	180
P109049W	52	73	1	NWNE	STO,CBNG	HALL 31C-123	REDSTONE RESOURCES, INC.	351	153
P161013W	52	73	1	SENE	CBNG	HALL 42A-123	MAJESTIC PETROLEUM OPERATIONS, LLC	193	135
P107781W	52	73	1	SENE	STO,CBNG	HALL 42C-123	REDSTONE RESOURCES, INC	365	174
P26476W	52	73	1	NENW	MIS	HALL #5	MEADOWLARK FARMS INC.**JOY LUCILLE HALL	600	140
P109051W	52	73	1	NWNW	STO,MIS,CBNG	HALL 11C-123	REDSTONE RESOURCES, INC.	362	90
P103487W	52	73	1	SWNW	STO,MIS,CBNG	HALL #32C-123	REDSTONE RESOURCES, INC		
P109050W	52	73	1	SENW	STO,MIS,CBNG	HALL 22C-123	REDSTONE RESOURCES, INC.	346	111
P109040W	52	73	1	SWSW	STO,MIS,CBNG	HALL 14C-123	REDSTONE RESOURCES, INC.	456	200
P109278W	52	73	1	NWSE	STO,CBNG	HALL 33C-123	REDSTONE RESOURCES, INC.	331	131
P107782W	52	73	1	SESE	STO,CBNG	OEDEKOVEN 22C-722	REDSTONE RESOURCES, INC	434	216
P103179W	52	73	2	NENE	STO,MIS,CBNG	HALL #41C-223	REDSTONE RESOURCES, INC		
P109041W	52	73	2	NWNE	STO,MIS,CBNG	HALL 31C-223	REDSTONE RESOURCES, INC.	409	153
P103181W	52	73	2	NWNE	STO,MIS,CBNG	HALL #31C-223	REDSTONE RESOURCES, INC		
P103178W	52	73	2	SWNE	STO,MIS,CBNG	HALL #32C-223	REDSTONE RESOURCES, INC		
P118218W	52	73	2	NENW	STO,CBNG	Landeck Fed 21C-223	DEVON ENERGY PRODUCTION CO. L.P.	498	295
P103475W	52	73	2	NWNW	STO,MIS,CBNG	LANDECK #11C-223	REDSTONE RESOURCES, INC		
P177789W	52	73	2	SWNW	STO,CBNG	LANDECK 12C-223	DEVON ENERGY PRODUCTION CO. L.P.	489	153
P110633W	52	73	2	SWNW	STO,CBNG	LANDECK 12C-223	REDSTONE RESOURCES, INC.	489	154
P135506W	52	73	2	SWNW	CBNG	LANDECK 12A-223	DEVON ENERGY PRODUCTION CO. L.P.	170	149
P131903W	52	73	2	SWNW	CBNG	Landeck 12W - 223	DEVON ENERGY PRODUCTION CO. L.P.	768	426
P116607W	52	73	2	NESW	STO,CBNG	LANDECK 23C-223	DEVON ENERGY PRODUCTION CO. L.P.	494	377

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P103045W	52	73	2	NWSW	STO,MIS,CBNG	LANDECK #13C-223	REDSTONE RESOURCES, INC		
P131901W	52	73	2	SWSW	CBNG	Landeck 14W - 223	DEVON ENERGY PRODUCTION CO. L.P.	800	612
P35585W	52	73	2	SWSW	MON	B2 9C	GULF MINERAL RESOURCES COMPANY	547	-1
P26478W	52	73	2	SESW	MIS	HALL #7	MEADOWLARK FARMS INC.**JOY LUCILLE HALL	520	210
P109043W	52	73	2	NESE	STO,MIS,CBNG	HALL 43C-223	REDSTONE RESOURCES, INC.	390	133
P103186W	52	73	2	NESE	STO,MIS,CBNG	HALL #43C-223	REDSTONE RESOURCES, INC		
P131897W	52	73	2	NESE	CBNG	Hall 43 W - 223	DEVON ENERGY PRODUCTION CO. L.P.	724	212
P103184W	52	73	2	NWSE	STO,MIS,CBNG	HALL #33C-223	REDSTONE RESOURCES, INC		
P103185W	52	73	2	SWSE	STO,MIS,CBNG	HALL #34C-223	REDSTONE RESOURCES, INC		
P103182W	52	73	2	SESE	STO,MIS,CBNG	HALL #44C-223	REDSTONE RESOURCES, INC		
P109042W	52	73	2	SESE	STO,MIS,CBNG	HALL 34C-223	REDSTONE RESOURCES, INC.	460	191
P110635W	52	73	3	NENE	STO,CBNG	LANDECK 41C-323	REDSTONE RESOURCES, INC.	499	147
P177786W	52	73	3	NENE	STO,CBNG	LANDECK 41C-323	DEVON ENERGY PRODUCTION CO. L.P.	499	147
P131895W	52	73	3	SWNE	CBNG	Landeck 32W - 323	DEVON ENERGY PRODUCTION CO. L.P.	787	776
P103187W	52	73	3	SWNE	STO,MIS,CBNG	LANDECK #32C-323	DEVON ENERGY PRODUCTION CO. L.P.		
P101093W	52	73	3	SWNE	MON	LANDECK ST 423-1	REDSTONE RESOURCES, INC	588	88
P135514W	52	73	3	SWNE	CBNG	LANDECK 32A-323	DEVON ENERGY PRODUCTION CO. L.P.	187	132
P103044W	52	73	3	SENE	STO,MIS,CBNG	LANDECK #42C-323	REDSTONE RESOURCES, INC		
24/1/411W	52	73	3	NESW					
P110216W	52	73	3	NESW	STO,CBNG	LANDECK 23B-323	Redstone Resources	800	141
P102865W	52	73	3	NESW	STO,MIS,CBNG	LANDECK #23C-323	DEVON ENERGY PRODUCTION CO. L.P.	480	-4
24/3/411W	52	73	3	NESW					
39/4/414W	52	73	3	NESW	STO,MIS	LANDECK 23B-423	DEVON ENERGY PRODUCTION CO. L.P.		
P116620W	52	73	3	SESW	STO,CBNG	LANDECK 24B2-323	DEVON ENERGY PRODUCTION CO. L.P.	788	160

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P102866W	52	73	3	NESE	STO,MIS,CBNG	LANDECK #43C-323	DEVON ENERGY PRODUCTION CO. L.P.		
P36326W	52	73	3	NESE	MON	B3-13C #1	GULF MINERAL RESOURCES COMPANY**J. F. MUIRHEAD		
P131893W	52	73	3	NESE	CBNG	Landeck 43W2 - 323	DEVON ENERGY PRODUCTION CO. L.P.	785	748
P135519W	52	73	3	NESE	CBNG	LANDECK 43A-323	DEVON ENERGY PRODUCTION CO. L.P.	179	-7
P135516W	52	73	3	SWSE	CBNG	LANDECK 34A-323	DEVON ENERGY PRODUCTION CO. L.P.	153	132
P159038W	52	73	3	SWSE	CBNG,RES	LANDECK 03-1	DEVON ENERGY PRODUCTION COMPANY, L.P.**WILLIAM A. LANDECK	499	89
39/9/425W	52	73	10	NENE	STO,CBNG	HINKES 41C-1023	DEVON ENERGY PRODUCTION CO. L.P.		
P108242W	52	73	10	NENE	STO,CBNG	HINKES 41C-1023	DEVON ENERGY PRODUCTION COMPANY, L.P	489	112
P131909W	52	73	10	NENE	CBNG	Hinkes 41A - 1023	DEVON ENERGY PRODUCTION CO. L.P.	152	140
P108736W	52	73	10	SWNE	STO,CBNG	HINKES 32C-1023	DEVON ENERGY PRODUCTION COMPANY, L.P	802	745
P131892W	52	73	10	NENW	CBNG	Landeck 21A-1023	DEVON ENERGY PRODUCTION CO. L.P.	235	141
P106271W	52	73	10	NENW	STO,CBNG	LANDECK 21B-1023	REDSTONE RESOURCES, INC	750	400
P106789W	52	73	10	NENW	STO,CBNG	LANDECK 21C-1023	DEVON ENERGY PRODUCTION CO. L.P.	473	99
P131905W	52	73	10	NESW	CBNG	Landeck 23W-1023	DEVON ENERGY PRODUCTION CO. L.P.	858	628
P131891W	52	73	10	NESW	CBNG	Landeck 23A-1023	DEVON ENERGY PRODUCTION CO. L.P.	270	230
P159035W	52	73	10	NESW	CBNG,RES	LINDQUIST 23C-1023	DEVON ENERGY PRODUCTION COMPANY, L.P.**WILLIAM A. LANDECK	583	151
25/3/42W	52	73	10	SESW					
25/12/46W	52	73	10	SESW					
25/5/42W	52	73	10	SESW					
25/6/42W	52	73	10	SESW					
P103476W	52	73	10	SESW	STO,MIS,CBNG	LANDECK #24C-1023	REDSTONE RESOURCES, INC		
25/8/42W	52	73	10	SESW					

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
25/2/42W	52	73	10	SESW					
25/11/46W	52	73	10	SESW					
25/10/46W	52	73	10	SESW					
25/4/42W	52	73	10	SESW					
25/9/42W	52	73	10	SESW					
25/7/42W	52	73	10	SESW					
P108245W	52	73	10	NESE	STO,CBNG	HINKES 43C-1023	REDSTONE RESOURCES, INC	447	113
P131911W	52	73	10	NESE	CBNG	Hinkes 43 A - 1023	DEVON ENERGY PRODUCTION CO. L.P.	209	94.5
39/7/425W	52	73	10	NESE	STO,CBNG	HINKES 43C-1023	DEVON ENERGY PRODUCTION CO. L.P.		
P131908W	52	73	10	SWSE	CBNG	Hinkes 34W - 1023	DEVON ENERGY PRODUCTION CO. L.P.	823	790
P108246W	52	73	10	SWSE	STO,CBNG	HINKES 34C-1023	REDSTONE RESOURCES, INC	480.5	119
P131907W	52	73	10	SWSE	CBNG	Hinkes 34A - 1023	DEVON ENERGY PRODUCTION CO. L.P.	266	163
39/6/425W	52	73	10	SWSE	STO,CBNG	HINKES 34C-1023	DEVON ENERGY PRODUCTION CO. L.P.		
P130318W	52	73	11	NENE	CBNG	HALL 41A-1123	DEVON ENERGY PRODUCTION CO. L.P.	304	160
P109046W	52	73	11	NENE	STO,MIS,CBNG	HALL 41C-1123	REDSTONE RESOURCES, INC.	534	232
P131919W	52	73	11	SWNE	CBNG	HALL 32A-1123	DEVON ENERGY PRODUCTION CO. L.P.	383	197
P109045W	52	73	11	SWNE	STO,MIS,CBNG	HALL 32C-1123	REDSTONE RESOURCES, INC.	488	174
P131920W	52	73	11	SWNE	CBNG	HALL 32W-1123	DEVON ENERGY PRODUCTION CO. L.P.	803	765
P109044W	52	73	11	NENW	STO,CBNG	HINKES 21C-1123	REDSTONE RESOURCES, INC.	456	143
P108243W	52	73	11	SWNW	STO,CBNG	HINKES 12C-1123	DEVON ENERGY PRODUCTION COMPANY, L.P	425	101
39/8/425W	52	73	11	SWNW	STO,CBNG	HINKES 12C-1123	DEVON ENERGY PRODUCTION CO. L.P.		
P131652W	52	73	11	SWNW	CBNG	HINKES 12A-1123	DEVON ENERGY PRODUCTION CO. L.P.	230	130
P131917W	52	73	11	NESW	CBNG	Hinkes 23A-1123	DEVON ENERGY PRODUCTION CO. L.P.	285	175
P132275W	52	73	11	NESW	CBNG	TWENTY MILE 43W-1123	DEVON ENERGY PRODUCTION CO. L.P.	811	758

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P108866W	52	73	11	NESW	STO,CBNG	HINKES 23C-1123	DEVON ENERGY PRODUCTION COMPANY, L.P	413	116
P131914W	52	73	11	SWSW	CBNG	Hinkes 14 W - 1123	DEVON ENERGY PRODUCTION CO. L.P.	774	486
P108247W	52	73	11	SWSW	STO,CBNG	HINKES 14C-1123	REDSTONE RESOURCES, INC	460	127
39/5/425W	52	73	11	SWSW	STO,CBNG	HINKES 14C-1123	DEVON ENERGY PRODUCTION CO. L.P.		
P131651W	52	73	11	SWSW	CBNG	HINKES 14A-1123	DEVON ENERGY PRODUCTION CO. L.P.	198	125
P130319W	52	73	11	NESE	CBNG	TWENTY MILE 43A-1123	DEVON ENERGY PRODUCTION CO. L.P.	323	152
P131921W	52	73	11	NESE	CBNG	TWENTY MILE 43 C-1123	DEVON ENERGY PRODUCTION CO. L.P.	538	489
P131926W	52	73	11	SWSE	CBNG	TWENTY MILE 34A-1123	DEVON ENERGY PRODUCTION CO. L.P.	340	178
P132273W	52	73	11	SWSE	CBNG	TWENTY MILE 34W-1123	DEVON ENERGY PRODUCTION CO. L.P.	792	602
P120894W	52	73	11	SWSE	STO,CBNG	Twenty Mile 34C-1123	DEVON ENERGY PRODUCTION CO. L.P.	508	385
P109048W	52	73	11	SESE	STO,CBNG	TWENTY MILE 44C-1123	REDSTONE RESOURCES, INC.	516	169
P108435W	52	73	12	NENE	STO,CBNG	COOK 41C-1223	REDSTONE RESOURCES, INC	390	330
P108431W	52	73	12	NWNE	STO,CBNG	COOK 31C-1223	REDSTONE RESOURCES, INC	373	137
P141900W	52	73	12	NENW	STO,CBNG	COOK 21A1-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	105	71
P108427W	52	73	12	NENW	STO,CBNG	COOK 21C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	429	379
P108423W	52	73	12	NWNW	STO,CBNG	COOK 11C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	497	202
P142354W	52	73	12	SWNW	STO,CBNG	COOK 12W-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	834	295
P108424W	52	73	12	SWNW	STO,CBNG	COOK 12C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	539	473
P130156W	52	73	12	SWNW	CBNG	COOK 12A-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	312	200
P108428W	52	73	12	SENW	STO,CBNG	COOK 22C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	435	170
P108425W	52	73	12	NWSW	STO,CBNG	COOK 13C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	522	231
P131321W	52	73	12	SWSW	CBNG	COOK 14A-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	295	210
P108426W	52	73	12	SWSW	STO,CBNG	COOK 14C-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	520	472
P108430W	52	73	12	SESW	STO,CBNG	COOK 24C-1223	REDSTONE RESOURCES, INC	466	221

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P108433W	52	73	12	NWSE	STO,MIS,CBNG	COOK 33C-1223	REDSTONE RESOURCES, INC	395	14
P108434W	52	73	12	SWSE	STO,CBNG	COOK 34C-1223	REDSTONE RESOURCES, INC	380	357
P141901W	52	73	12	SWSE	STO,CBNG	COOK 34A-1223	MAJESTIC PETROLEUM OPERATIONS, LLC	154	119
P108438W	52	73	12	SESE	STO,CBNG	COOK 44C-1223	REDSTONE RESOURCES, INC	310	12
P110084W	52	73	13	NENE	STO,CBNG	COOK 41C-1323	MAJESTIC PETROLEUM OPERATIONS, LLC	332	90.5
P107670W	52	73	13	NWNE	STO,CBNG	COOK 31C-1323	REDSTONE RESOURCES, INC	389	58.5
P131654W	52	73	13	SWNE	CBNG	COOK 32A-1323	MAJESTIC PETROLEUM OPERATIONS, LLC	233	212
P33812W	52	73	13	SENE	DOM,STO	COOK #1	CECLE L. COOK	130	50
P107783W	52	73	13	SENE	STO,CBNG	COOK 42C-1323	MAJESTIC PETROLEUM OPERATIONS, LLC	393	119
P109047W	52	73	13	NWNW	STO,CBNG	COOK 11C-1323	REDSTONE RESOURCES, INC.	536	257
P120603W	52	73	13	SENW	STO,CBNG	Cook 22C3-1323	DEVON ENERGY PRODUCTION CO. L.P.	604	583
P67024W	52	73	13	NESW	DOM	RAY #1	DARRELL RAY	296	134
P107600W	52	73	13	NESW	STO,MIS,CBNG	OEDEKOVEN 23C-1323	REDSTONE RESOURCES, INC	539	247
P131650W	52	73	13	NESW	CBNG	OEDEKOVEN 23A-1323	REDSTONE RESOURCES INC.	300	53
P67063W	52	73	13	NESW	DOM	PETERSEN #1	KERRY L. PETERSEN	250	85
P110083W	52	73	13	NWSW	STO,CBNG	GEIGER 13C-1323	REDSTONE RESOURCES, INC.	440	214
P111695W	52	73	13	SWSW	STO,CBNG	Geiger 14C-1323	DEVON ENERGY PRODUCTION CO. L.P.	461	59
P107929W	52	73	13	SESW	STO,MIS,CBNG	OEDEKOVEN 24C-1323	REDSTONE RESOURCES, INC	525	230
P107601W	52	73	13	SWSE	STO,MIS,CBNG	OEDEKOVEN 34C-1323	REDSTONE RESOURCES, INC	585	293
P131649W	52	73	13	SWSE	CBNG	OEDEKOVEN 34A-1323	REDSTONE RESOURCES INC.	298	190
P107038W	52	73	13	SESE	CBNG,MIS	OEDEKOVEN 44C-1323	REDSTONE RESOURCES, INC	523	290
P142661W	52	73	14	SWNE	CBNG	TWENTY MILE 32A-1423	REDSTONE RESOURCES INC.	370	242
P122295W	52	73	14	SWNE	STO,CBNG	Twenty Mile 32C-1423	DEVON ENERGY PRODUCTION COMPANY, L.P	511	379
P131643W	52	73	14	SWNE	CBNG	TWENTY MILE 32A-1423	DEVON ENERGY PRODUCTION CO. L.P.	370	242

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P8545P	52	73	14	NENW	STO	MOREL #3	MAURICE MOREL	4	-4
39/4/425W	52	73	14	NENW	STO,CBNG	TWENTY MILE 21C-1423	DEVON ENERGY PRODUCTION CO. L.P.		
P162008W	52	73	14	NENW	CBNG	TWENTY MILE 21C-1423	20 MILE LAND COMPANY** DEVON ENERGY PRODUCTION CO. L.P.		
P8543P	52	73	14	NWNW	DOM,STO	MOREL #1	MAURICE MOREL	185	80
P159023W	52	73	14	SWNW	CBNG,RES	TWENTY MILE 12C2-1423	DEVON ENERGY PRODUCTION COMPANY, L.P.** 20 MILE LAND COMPANY	577	348
P8412W	52	73	14	SENW	STO	MOREL #4	MAURICE MOREL	84	10
P103580W	52	73	14	SENW	DOM	JANISH #1	DAVE JANISH	790	250
P120895W	52	73	14	NESW	STO,CBNG	Twenty Mile 23C-1423	DEVON ENERGY PRODUCTION COMPANY, L.P	592	397
P132280W	52	73	14	SWSW	CBNG	TWENTY MILE 14W-1423	DEVON ENERGY PRODUCTION CO. L.P.	884	814
P15860W	52	73	14	NESE	STO	PITT #1	REGINALD PARNELL	102	37
P94853W	52	73	14	SWSE	STO	HARDY A1	KELLY HARDY	222	70
P122288W	52	73	14	SWSE	STO,CBNG	HUSKINSON 34C-1423	DEVON ENERGY PRODUCTION COMPANY, L.P	536	307
39/1/502W	52	73	14	SWSE	DOM,MIS	DIRT WORLD #1	CHUCK & MARRIA RUIZ		
P94590W	52	73	14	SESE	MON	GVE-MW2	GREEN VALLEY ESTATES	33	22.5
P132287W	52	73	15	NENE	CBNG	TWENTY MILE 41D-1523	DEVON ENERGY PRODUCTION CO. L.P.	1349	579
P107784W	52	73	15	NENE	STO,CBNG	TWENTY MILE 41C-1523	REDSTONE RESOURCES, INC	496	132
P132285W	52	73	15	NENE	CBNG	TWENTY MILE 32A-1523	DEVON ENERGY PRODUCTION CO. L.P.	312	188
P132289W	52	73	15	NENE	CBNG	TWENTY MILE 41A-1523	DEVON ENERGY PRODUCTION CO. L.P.	206	141
P174683W	52	73	15	NENE	CBNG	TWENTY MILE 41LC-1523	DEVON ENERGY PRODUCTION CO. L.P.** 20 Mile Land Co.		
P8544P	52	73	15	SENE	STO	MOREL #2	MAURICE MOREL	120	20
P174685W	52	73	15	NENW	CBNG	TWENTY MILE 21C-1523	DEVON ENERGY PRODUCTION CO. L.P.** 20 Mile Land Co.		

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P132288W	52	73	15	NESE	CBNG	TWENTY MILE 43A-1523	DEVON ENERGY PRODUCTION CO. L.P.	223	147
P132286W	52	73	15	SWSE	CBNG	TWENTY MILE 34A-1523	DEVON ENERGY PRODUCTION CO. L.P.	302	190
P132291W	52	73	22	NENE	CBNG	TWENTY MILE 41A-2223	DEVON ENERGY PRODUCTION CO. L.P.	247	159
P159019W	52	73	22	NENE	CBNG,RES	TWENTY MILE 41C-2223	DEVON ENERGY PRODUCTION COMPANY, L.P.** 20 MILE LAND COMPANY	535	200
P132290W	52	73	22	SWNE	CBNG	TWENTY MILE 32A-2223	DEVON ENERGY PRODUCTION CO. L.P.	308	230
P115820W	52	73	22	SWNE	STO,CBNG	TWENTY MILE 32C-2223	DEVON ENERGY PRODUCTION CO. L.P.	603	248
P137337W	52	73	22	NESE	CBNG	TWENTY MILE FED 43C-2223	DEVON ENERGY PRODUCTION CO. L.P.	582	498
P137334W	52	73	22	SWSE	CBNG	TWENTY MILE FED 34C-2223	DEVON ENERGY PRODUCTION CO. L.P.	699	621
P118851W	52	73	23	NENE	STO,CBNG	Green Valley 41C-2323	REDSTONE RESOURCES, INC.	530	55
P161032W	52	73	23	NENE	CBNG	MOREL 41A-2323	MAJESTIC PETROLEUM OPERATIONS, LLC	308	250
P120897W	52	73	23	SWNE	STO,CBNG	Triton 32C-2323	Redstone Resources	689	545
P42086W	52	73	23	SWNE	MIS	MOREL #1	MAURICE MOREL**ROBERT MOREL**GERALD MOREL** S AND R LAND CO.	1260	370
P91376W	52	73	23	SWNE	MIS	MOREL #1	GREEN VALLEY ESTATES	1260	370
P159049W	52	73	23	SWNE	CBNG,RES	MOREL 32CR-2323	DEVON ENERGY PRODUCTION COMPANY, L.P.**GERALD M MOREL	688	250
P108931W	52	73	23	SENE	STO,CBNG	TRITON 42C-2323	REDSTONE RESOURCES, INC.	576	308
P149408W	52	73	23	SENE	DOM,STO	CODY # 1	CODY JOSLYN		
P127901W	52	73	23	NENW	CBNG	TWENTY MILE 21C-2323	DEVON ENERGY PRODUCTION CO. L.P.	632	327
P34476W	52	73	23	SENW	MON	MOREL #1 TEST HOLE	MAURICE MOREL** S & R LAND COMPANY**ROBERT MOREL**GERALD MOREL	1260	370
P137328W	52	73	23	SWSW	CBNG	TWENTY MILE FED 14C-2323	REDSTONE RESOURCES INC.		
P116611W	52	73	23	NESE	STO,CBNG	TRITON 43C-2323	DEVON ENERGY PRODUCTION CO. L.P.	657	218
P115504W	52	73	24	NENE	STO	ROBB E #1E	BYRON F/MARJORIE OEDEKOVEN	300	75

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P106641W	52	73	24	NENE	STO,MIS,CBNG	OEDEKOVEN 41C-2423	REDSTONE RESOURCES, INC	466	223
P108421W	52	73	24	NWNE	STO,MIS,CBNG	OEDEKOVEN 31C-2423	REDSTONE RESOURCES, INC	540	261
P107599W	52	73	24	NENW	STO,MIS,CBNG	OEDEKOVEN 21C-2423	REDSTONE RESOURCES, INC	466	197
P110086W	52	73	24	NWNW	STO,CBNG	MOREL 11C-2423	REDSTONE RESOURCES, INC.	519	315
40/4/291W	52	73	24	NWNW	MIS	GREEN VALLEY NO II PHASE III	GERALD M & LOIS A MOREL		
P149409W	52	73	24	SWNW	DOM,STO	SCOTT JOSLYN #1	SCOTT JOSLYN		
P118850W	52	73	24	SWNW	STO,CBNG	Green Valley 12C-2423	REDSTONE RESOURCES, INC.	570	102
P115512W	52	73	24	SENW	STO	ROBB W #1W	BYRON F/MARJORIE OEDEKOVEN	43.4	6
P92236W	52	73	24	SENW	DOM,STO	PALMER #1	GENE AND GLENDA PALMER	655	200
P107928W	52	73	24	NESW	STO,MIS,CBNG	OEDEKOVEN 23C-2423	REDSTONE RESOURCES, INC	550	285
P116619W	52	73	24	SWSW	STO,CBNG	TRITON 14C-2423	DEVON ENERGY PRODUCTION CO. L.P.	622	468
P107737W	52	73	24	NESE	STO,CBNG	OEDEKOVEN 43C-2423	REDSTONE RESOURCES, INC	452	254
P109591W	52	73	24	NWSE	STO,MIS,CBNG	OEDEKOVEN 33C2-2423	REDSTONE RESOURCES, INC.	439	165
P104886W	52	73	24	SWSE	STO,MIS,CBNG	OEDEKOVEN 34SA-2423	REDSTONE RESOURCES, INC	456	236
P104887W	52	73	24	SESE	STO,MIS,CBNG	OEDEKOVEN 44SC-2423	REDSTONE RESOURCES, INC	457	249
25/11/287W	52	73	25	NENE					
25/1/288W	52	73	25	NENE					
P106510W	52	73	25	NENE	STO,MIS,CBNG	TRITON 41C-2523	REDSTONE RESOURCES, INC	412	185
25/12/287W	52	73	25	NENE					
P112366W	52	73	25	NWNE	STO,CBNG	Olin CS #1	YATES PETROLEUM CORP.** SMC MINING COMPANY		
P103616W	52	73	25	SENE	STO,MIS,CBNG	TRITON #42A-2523	REDSTONE RESOURCES, INC	178.5	-1
P107785W	52	73	25	NENW	STO,CBNG	TRITION 21C-2523	REDSTONE RESOURCES, INC	529	255
P150294W	52	73	25	NENW	DOM	SANTISTEVAN # 1	CHRIS SANTISTEVAN	890	432

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P69602W	52	73	25	NWNW	DOM	SULLIVAN #1	CHARLES P. SULLIVAN	820	400
P159024W	52	73	25	NWNW	CBNG,RES	TRITION 11A-2523	DEVON ENERGY PRODUCTION COMPANY, L.P.** TRITON COAL COMPANY	419	181
P56384W	52	73I	25	NWNW	DOM,STO	PINEVIEW #1	HELEN HAFLING		
P63294W	52	73	25	NWNW	DOM	REISTER #1	CLYDE LANCE REISTER		
40/8/15W	52	73	25	NWNW	DOM	KLINE #1	THOMAS KLINE		
P56385W	52	73	25	SWNW	DOM,STO	PINEVIEW #2	HELEN HAFLING	785	300
P154536W	52	73	25	SWNW	MIS	GLORY HOLE #1	GLORY HOLE HOMEOWNERS ASSN.	1200	565
P114668W	52	73	25	SWNW	STO,CBNG	WARE 12C-2523	DEVON ENERGY PRODUCTION CO. L.P.	645	448
P41579W	52	73	25	SWNW	DOM	BREDTHAUER #1	CHARLES E. AND CINDY S. BREDTHAUER	705	350
P65773W	52	73	25	SWNW	MIS	ENL BREDTHAUER #1	CHARLES E. & CINDY S. BREDTHAUER	705	320
P177565W	52	73	25	SENW	DOM	BREDTHAUER #1 REPLACEMENT WELL	CHARLES E & CINDY S. BREDTHAUER		
P112700W	52	73	25	SENW	STO,CBNG	TRITON 22EB-2523	REDSTONE RESOURCES, INC.	0	0
P51185W	52	73	25	SENW	DOM	H H #1	SUSAN M MOORE	660	240
P110161W	52	73	25	SENW	DOM	MATLACK #1	GLENDA H MATLACK	665	100
39/8/305W	52	73	25	SENW	MIS	BREDTHAVER #1 REPLACEMENT WELL	CHARLES E. & CINDY S. BREDTHAVER		
P111067W	52	73	25	NWSW	DOM,STO	Eberlein 1	RICHARD EBERLEIN		
P55199W	52	73	25	NWSW		BRUSKI #1	LAWRENCE BRUSKI	330	160
P56386W	52	73	25	NWSW	DOM,STO	PINEVIEW #3	HELEN HAFLING		
P114669W	52	73	25	NWSW	STO,CBNG	COLEMAN 13C-2523	REDSTONE RESOURCES, INC.	325	-1
P168613W	52	73	25	NWSW	DOM	DCW #1	DANA & CHRISTINE WILLIAMS**MIKE & LORI CADA**JARED BRYAN	760	385
P59551W	52	73	25	NWSW	DOM	CONNOLLY #1	JACK P. & VICTORIA L. CONNOLLY	800	375

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P72895W	52	73	25	SWSW	DOM,STO	PINEVIEW #4	ROGER & MARY MAKI**BROOK & LORI BAHNSON**MARK THOMAS	790	365
P114670W	52	73	25	SWSW	STO,CBNG	HOLDEN 14C-2523	DEVON ENERGY PRODUCTION CO. L.P.	516	54
P73385W	52	73	25	SWSW	DOM,STO	BRIGGS #1	ALBERT L. BRIGGS	755	300
P56387W	52	73	25	SWSW	DOM,STO	PINEVIEW #4	HELEN HAFLING		
P157966W	52	73	25	SESW	DOM	JEWETT #1	JAMES & KAREN JEWETT	650	404
25/10/123W	52	73	25	NESE					
25/11/123W	52	73	25	NESE					
25/3/124W	52	73	25	NESE					
25/1/124W	52	73	25	NESE					
25/12/123W	52	73	25	NESE					
25/2/124W	52	73	25	NESE					
P103615W	52	73	25	NWSE	STO,MIS,CBNG	TRITON #33A-2523	REDSTONE RESOURCES, INC	163	0
P34782W	52	73	25	SWSE	DOM,STO	S BARBOUR #1	STEVEN R. OR GEORGIA L. BARBOUR	200	120
P66876W	52	73	25	SWSE	DOM	S. BARBOUR #2	STEVEN R. OR GEORGIA L. BARBOUR	717	350
P117223W	52	73	25	SESE	STO,CBNG	NORTH KITTY FEE #44-25	KENNEDY OIL	660	410
P103617W	52	73	25	SESE	STO,MIS,CBNG	TRITON #44A-2523	REDSTONE RESOURCES, INC	153	0
P106511W	52	73	25	SESE	STO,MIS,CBNG	TRITON 44C-2523	REDSTONE RESOURCES, INC	395	-4
39/6/454W	52	73	25		DOM	ROGERS #1	RALPH & LAURA ROGERS		
P57369W	52	73	26	NWNE	DOM,STO	HOLDEN #1	ORVIL L. HOLDEN	625	170
P47170W	52	73	26	NWNE	DOM,STO	HOLDEN #1	ORVIL L. HOLDEN		
P43866W	52	73	26	SWNE	DOM,STO	ELDRIDGE #1	EDWARD W. & LINDA K. ELDRIDGE	325	175
P109627W	52	73	26	NENW	STO,CBNG	TRITON FEDERAL 21C-2623	REDSTONE RESOURCES, INC.	700	276
39/10/543W	52	73	26	NENW	DOM,STO	ELDRIDGE #2	EDWARD W. & LINDA K. ELDRIDGE		

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
39/1/426W	52	73	26	NENW	STO,CBNG	TRITON FEDERAL 21C-2623	DEVON ENERGY PRODUCTION CO. L.P.		
P36583W	52	73	26	NESW	DOM,STO	RAYS #2	RAYMOND PODENSKI	580	475
P38967W	52	73	26	NWSW	DOM	JOHNSON WELL #1	BOB LEROY JOHNSON	260	200
P141398W	52	73	26	SWSW	CBNG	TWENTY MILE 14A-2623	DEVON ENERGY PRODUCTION CO. L.P.	573	429
P115521W	52	73	26	SWSW	STO,CBNG	TWENTY MILE 14C-2623	REDSTONE RESOURCES, INC.	741	240
P65774W	52	73	26	NESE	MIS	B-WEST #1	BREDTHAUER-WEST HOME OWERNERS ASSOCIATION	710	150
P122771W	52	73	26	NESE	STO,CBNG	MOORE 43C-2623	DEVON ENERGY PRODUCTION CO. L.P.	639	278
P123899W	52	73	26	NWSE	DOM,STO	ELLISTON #1	ELLISTON COMPANY		
P161014W	52	73	26	SWSE	CBNG	20-MILE 34A-2623	MAJESTIC PETROLEUM OPERATIONS, LLC	268	170
P43864W	52	73	26	SWSE	DOM,STO	ONETIA #1	HORACE RAY COLLINS	442	225
P65156W	52	73	26	SWSE	DOM	BUTCHER #1	DUANE BUTCHER	790	475
P144736W	52	73	27	NWSE	CBNG	NORTH KITTY FEREDAL 33-27B	KENNEDY OIL	551	410
P144741W	52	73	27	NWSE	CBNG	NORTH KITTY FEDERAL 33-27A	KENNEDY OIL		
P147681W	52	73	27	SWSE	CBNG	NORTH KITTY FEDERAL 34-27A	KENNEDY OIL	717	4001
P144737W	52	73	27	SESE	CBNG	NORTH KITTY FEREDAL 44-27B	KENNEDY OIL	733	530
P144742W	52	73	27	SESE	CBNG	NORTH KITTY FEDERAL 44-27A	KENNEDY OIL		
P145026W	52	73	34	SENW	CBNG	NORTH KITTY FEDERAL 22-34B	KENNEDY OIL	866	666
P144740W	52	73	34	SENW	CBNG	NORTH KITTY FEREDAL 22-34A	KENNEDY OIL	930	670
P67073W	52	73	35	NWNE	STO	VIDETA #1	TWENTY MILE LAND CO.	250	84
P109275W	52	73	35	NENW	STO,MIS,CBNG	TWENTY MILE 21C-3523	REDSTONE RESOURCES, INC.	662	242
P115523W	52	73	35	SWNW	STO,CBNG	TWENTY MILE 12C-3523	DEVON ENERGY PRODUCTION CO. L.P.	687	180
P116612W	52	73	35	NESW	STO,CBNG	TWENTY MILE 23C-3523	DEVON ENERGY PRODUCTION CO. L.P.	680	198
25/7/59W	52	73	36	NENE					

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
25/3/59W	52	73	36	NENE					
25/5/59W	52	73	36	NENE					
25/4/59W	52	73	36	NENE					
25/6/59W	52	73	36	NENE					
25/2/59W	52	73	36	NENE					
P103612W	52	73	36	NENE	STO,MIS,CBNG	STATE #41A-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	129.5	0
P105074W	52	73	36	NWNE	STO,CBNG	STATE 31A-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	426	177
24/5/260W	52	73	36	SWNE					
P104527W	52	73	36	SENE	STO,MIS,CBNG	STATE 42A-3623	REDSTONE RESOURCES, INC	1283	0
25/4/315W	52	73	36	SENE					
P40771W	52	73	36	SENE	MON	RCH 2A	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	422	51
P106780W	52	73	36	SENE	STO,MIS,CBNG	STATE 42C-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	408	-1
P40772W	52	73	36	SENE	MON	RCH 2B	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	33	24.5
25/3/315W	52	73	36	SENE					
P107927W	52	73	36	NENW	STO,MIS,CBNG	STATE 21C-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	491	216
P131326W	52	73	36	NENW	CBNG	STATE 21D-3623	WY STATE BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES INC.	1351	823
25/12/297W	52	73	36	NWNW					
25/2/298W	52	73	36	NWNW					
25/3/298W	52	73	36	NWNW					
25/1/298W	52	73	36	NWNW					

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P106635W	52	73	36	NWNW	STO,CBNG	STATE 11C-3623	REDSTONE RESOURCES, INC	500	203
P105072W	52	73	36	SENW	STO,CBNG	STATE 22EC-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	459	171
P105071W	52	73	36	NWSW	STO,CBNG	STATE 13EA-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	508	159
25/9/169W	52	73	36	NWSW					
25/10/169W	52	73	36	NWSW					
25/11/169W	52	73	36	NWSW					
P161012W	52	73	36	SWSW	CBNG	STATE 14A-3623	MAJESTIC PETROLEUM OPERATIONS, LLC** WY STATE BOARD OF LAND COMMISSIONERS	218	170
P40769W	52	73	36	SWSW	MON	RCH 1B	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	130	70
P40767W	52	73	36	SWSW	MON	RCH 1	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	552	70
P40768W	52	73	36	SWSW	MON	RCH 1A	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	227	70
P111702W	52	73	36	SESW	STO,CBNG	State 24C-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC.	461	298
P105073W	52	73	36	NESE	STO,CBNG	STATE 43A-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	516	135
P106640W	52	73	36	NWSE	STO,CBNG	STATE 33C-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	428	156
25/3/304W	52	73	36	NWSE					
P105076W	52	73	36	SESE	STO,MIS,CBNG	STATE 44A-3623	WYO BOARD OF LAND COMMISSIONERS** REDSTONE RESOURCES, INC	422	129
P18183P	51	72	5	SENE	DOM,STO	JOHN #1	GILBERT OEDEKOVEN	450	150
P128642W	51	72	5	SWSW	CBNG	RAWHIDE 13-5	Medallion Exploration	240	135
P129239W	51	72	5	SESW	CBNG	RAWHIDE 14-5	Medallion Exploration	210	100

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
P103472W	51	72	6	NENW	STO,MIS,CBNG	CABALLO #21C-612	REDSTONE RESOURCES, INC	111	-1
P108927W	51	72	6	NENW	STO,MIS,CBNG	CABALLO 21C-612	DEVON ENERGY CORP. (NEVADA)	378	240
39/2/414W	51	72	6	NWNW	STO,MIS	CABALLO FEDERAL TFU 11C-612	DEVON ENERGY PRODUCTION CO. L.P.		
P110782W	51	72	6	NWNW	STO,CBNG	Caballo Fed. TFU 11C-612	DEVON ENERGY CORP.	358	34
P104713W	51	72	6	SENW	STO,CBNG	CABALLO 22C-612	DEVON ENERGY CORP. (NEVADA)	322	0
P110870W	51	72	6	NWSW	STO,CBNG	Caballo State TFU 13C-612	WY STATE BOARD OF LAND COMMISSIONERS** DEVON ENERGY CORP.	331	44
P126815W	51	72	6	NWSW	CBNG	CABALLO STATE TFU 13A-612	DEVON ENERGY PRODUCTION CO. L.P.** CABALLO COAL COMPANY	331	44
P111284W	51	72	6	SWSE	STO,CBNG	Caballo TFU 34C-612	DEVON ENERGY CORP.	264	97
25/8/162W	51	72	6	SESE					
25/9/162W	51	72	6	SESE					
39/8/413W	51	73	1	NWNE	STO,MIS	CABALLO TFU 31C-113	DEVON ENERGY PRODUCTION CO. L.P.		
P110786W	51	73	1	NWNE	STO,CBNG	Caballo Fed. TFU 31C-113	DEVON ENERGY CORP.	437	63
39/1/414W	51	73	1	SENE	STO,MIS	CABALLO TFU 42C-113	DEVON ENERGY PRODUCTION CO. L.P.		
P110783W	51	73	1	SENE	STO,CBNG	Caballo Fed. TFU 42C-113	DEVON ENERGY CORP.	422	40
39/9/412W	51	73	1	NWSW	STO,MIS	20 MILE 13C-113	DEVON ENERGY PRODUCTION CO. L.P.		
P131325W	51	73	1	NWSW	STO,CBNG	20 MILE 23A-1313	20 MILE LAND COMPANY** DEVON ENERGY PRODUCTION CO. L.P.	264	139
P110806W	51	73	1	NWSW	STO,CBNG	20 Mile TFU 13C-1413	DEVON ENERGY PRODUCTION CO. L.P.	533	42
P120554W	51	73	1	SESW	STO,CBNG	20 Mile 24C-113	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	448	330
P120555W	51	73	1	SESW	STO,CBNG	20 Mile 24A-113	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	214	25
P108420W	51	73	1	SESE	STO,CBNG	CABALLO FEDERAL 44C-113	DEVON ENERGY PRODUCTION COMPANY, L.P.	377	61
P110785W	51	73	1	SESE	STO,CBNG	Caballo Fed. TFU 44C-113	DEVON ENERGY CORP.	377	61

Appropriation	T	R	S	QQ	Permit Uses	Permit Facility Name	Permit Applicant	TD	SWL
39/9/413W	51	73	1	SESE	STO,MIS	CABALLO FEDERAL TFU 44C-113	DEVON ENERGY PRODUCTION CO. L.P.		
P120553W	51	73	2	NWNE	STO,CBNG	20 Mile 31A-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	420	40
P120552W	51	73	2	NWNE	STO,CBNG	20 Mile 31C-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	679	40
P120545W	51	73	2	SENE	STO,CBNG	20 Mile 42C-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	634	102
P120546W	51	73	2	SENE	STO,CBNG	20 Mile 42A-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	290	38
P120550W	51	73	2	NWSE	STO,CBNG	20 Mile 33C-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	634	222
P120551W	51	73	2	NWSE	STO,CBNG	20 Mile 33A-213	JOHN DALY** DEVON ENERGY PRODUCTION CO. L.P.	340	14

T = township; R = range; S = section; QQ = quarter-quarter; STO = stock; DOM = domestic; CBNG = coal bed natural gas; MON = monitoring; MIS/MISC = miscellaneous; IND = industrial; IRR = irrigation; RES = reservoir; OIL = oil refining/production; TEM = temporary filing; DRI = drilling; TD = total depth; SWL = static water level

[1] Points of use and coal company water rights are omitted

Table G-2. Surface Water Rights within 3 Miles of the General Analysis Area

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P3788S	53	72	27	SWSW	UNA	STO	Lena Stock Reservoir	GILBERT OEDEKOVEN	06/28/1961	Box Elder Creek/Draw
P3787S	53	72	29	SWSE	PU	STO	Gilbert Stock Reservoir	GILBERT OEDEKOVEN	06/28/1961	Gilbert Draw
P3787S	53	72	29	SESE	PU	STO	Gilbert Stock Reservoir	GILBERT OEDEKOVEN	06/28/1961	Gilbert Draw
31/2/78S	53	72	30	SENW	UNA	STO	Lynde #3 Stock Reservoir	Richard M. Lynde** Redstone Resources	04/19/2002	
31/3/78S	53	72	30	SWSW	UNA	STO	Lynde #4 Stock Reservoir	Richard M. Lynde** Redstone Resources	04/19/2002	
31/4/78S	53	72	30	SESW	UNA	STO	Lynde #5 Stock Reservoir	Richard M. Lynde** Redstone Resources	04/19/2002	
CR7/053A	53	72	30	SWSE	PU	STO	Calf Creek No. 2 Stock Reservoir	William A. Landeck	09/07/1971	Calf Creek Draw
CR7/053A	53	72	30	SWSE	PUO	STO	Calf Creek No. 2 Stock Reservoir	William A. Landeck	09/07/1971	Calf Creek Draw
P7139S	53	72	30	SWSE	PU	STO	Calf Creek No. 2 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	Calf Creek Draw
P7139S	53	72	30	SWSE	PUO	STO	Calf Creek No. 2 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	Calf Creek Draw
P16627S	53	72	31		UNA	STO	Lynde #6 Stock Reservoir	Devon Energy Prod. Co.**Richard & Judy Lynde	12/04/2001	Hanna Gulch
CR7/058A	53	72	31	NWSW	PU	STO	Spangler Stock Reservoir	William A. Landeck	09/07/1971	East Branch Spangler Draw
CR7/058A	53	72	31	NWSW	PUO	STO	Spangler Stock Reservoir	William A. Landeck	09/07/1971	East Branch Spangler Draw
P7137S	53	72	31	NWSW	PU	STO	Spangler Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East Branch Spangler Draw
P7137S	53	72	31	NWSW	PUO	STO	Spangler Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East Branch Spangler Draw
CR7/058A	53	72	31	SWSW	PU	STO	Spangler Stock Reservoir	William A. Landeck	09/07/1971	East Branch Spangler Draw
P7137S	53	72	31	SWSW	PU	STO	Spangler Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East Branch Spangler Draw
P15427S	53	72	32		UNA	STO	Oedekoven 3232 Stock Reservoir	Byron F. Oedekoven	04/25/2002	Corner Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P1543S	53	72	33	SWNE	UNA	STO	Tharp Stock Reservoir	FLOYD A THARP	08/27/1956	Box Elder Creek/Draw
P26613D	53	72	34	NWNE	DSC	OIL,TEM, IND,DRI	Orcus #1 Water Haul	DAVIS OIL COMPANY	06/06/1980	Little Powder River
P26613D	53	72	34	NWNE	PU	OIL,TEM, IND,DRI	Orcus #1 Water Haul	DAVIS OIL COMPANY	06/06/1980	Little Powder River
CR7/495A	53	72	34	NENW	PU	STO	Corner Stock Reservoir	D. C. Holler	05/15/1974	Corner Draw
CR7/495A	53	72	34	NENW	PUO	STO	Corner Stock Reservoir	D. C. Holler	05/15/1974	Corner Draw
P7712S	53	72	34	NENW	PU	STO	Corner Stock Reservoir	D. C. HOLLER	05/15/1974	Corner Draw
P7712S	53	72	34	NENW	PUO	STO	Corner Stock Reservoir	D. C. HOLLER	05/15/1974	Corner Draw
P6169S	53	72	34	SWSE	PU	STO	Coal Mine Stock Reservoir	JUNE C. BOISSONNAS**D.C. HOLLER	04/30/1968	June Draw
P6169S	53	72	34	SWSE	PUO	STO	Coal Mine Stock Reservoir	JUNE C. BOISSONNAS**D.C. HOLLER	04/30/1968	June Draw
P29316D	53	72	35	SWNE	PU	OIL,TEM, IND,DRI	Royal Federal 35-7 Water Haul	CONLEY P. SMITH	02/24/1986	COAL MINE DRAW
P29316D	53	72	35	NESW	PUD	OIL,TEM, IND,DRI	Royal Federal 35-7 Water Haul	CONLEY P. SMITH	02/24/1986	COAL MINE DRAW
P6170S	53	72	35	SWSE	PU	STO	Adon Stock Reservoir	JUNE C. BOISSONNAS**D.C. HOLLER	04/30/1968	COAL MINE DRAW
P6170S	53	72	35	SWSE	PUO	STO	Adon Stock Reservoir	JUNE C. BOISSONNAS**D.C. HOLLER	04/30/1968	COAL MINE DRAW
P6012S	53	73	35	NWSE	PU	STO	Landik Draw Stock Reservoir	DEAN W. HALL	07/31/1967	Landik Draw
P6012S	53	73	35	NWSE	PUO	STO	Landik Draw Stock Reservoir	DEAN W. HALL	07/31/1967	Landik Draw
P15501S	53	73	36	SESW	UNA	STO	Hall - Tate #3 Stock Reservoir	Devon Energy Production Company, L.P** WY STATE LANDS & INVESTMENTS**David and Rhoda Tate	09/07/2001	Haleakala Gulch
P27039D	52	72	2	NENE	DSC	OIL,TEM, IND,DRI	Coquina Oil Water Pump	COQUINA OIL CORPORATION	03/16/1981	Little Powder River

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P27039D	52	72	2	NENE	PU	OIL,TEM, IND,DRI	Coquina Oil Water Pump	COQUINA OIL CORPORATION	03/16/1981	Little Powder River
P14107D	52	72	3	SWSW	PUD	IRR	Gatch Ditch	EDNA N. GATCH	05/10/1916	Gatch Creek
P15427S	52	72	5	NENW	UNA	STO	Oedekoven 3232 Stock Reservoir	Byron F. Oedekoven	04/25/2002	Corner Draw
P3107S	52	72	5	SENW	PU	STO	Corner Stock Reservoir	GILBERT OEDEKOVEN	02/25/1960	Corner Draw
P3107S	52	72	5	SENW	PUO	STO	Corner Stock Reservoir	GILBERT OEDEKOVEN	02/25/1960	Corner Draw
CR7/054A	52	72	6	SWNE	PU	STO	Calf Creek No. 3 Stock Reservoir	William A. Landeck	09/07/1971	Calf Creek Draw
CR7/054A	52	72	6	SWNE	PUO	STO	Calf Creek No. 3 Stock Reservoir	William A. Landeck	09/07/1971	Calf Creek Draw
P7140S	52	72	6	SWNE	PU	STO	Calf Creek No. 3 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	Calf Creek Draw
P7140S	52	72	6	SWNE	PUO	STO	Calf Creek No. 3 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	Calf Creek Draw
P17750S	52	72	6	NESW	UNA	STO	Franklin #4 Stock Reservoir	Byron F. Oedekoven	04/25/2002	Golden Draw
P18348S	52	72	7	NENW	UNA	STO	Lingle #4 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Main Branch Hay Creek
P18348S	52	72	7	NWNW	UNA	STO	Lingle #4 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Main Branch Hay Creek
P18348S	52	72	7	SWNW	UNA	STO	Lingle #4 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Main Branch Hay Creek
P18348S	52	72	7	SENW	UNA	STO	Lingle #4 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Main Branch Hay Creek
P18347S	52	72	7	NESW	UNA	STO	Lingle #2 Stock Reservoir	Byron F. Oedekoven	01/19/2001	9-7 Draw
P18346S	52	72	7	NESW	UNA	STO	Lingle #1 Stock Reservoir	Byron F. Oedekoven	01/19/2001	BFO Draw
31/4/82S	52	72	8	SWNE	UNA	STO	Oedy #2 Stock Reservoir	BYRON F OEDEKOVEN** Redstone Resources	04/25/2002	
P14105D	52	72	9	NESE	PUD	IRR	West Ditch	EDNA N. GATCH	05/10/1916	West Creek
P14108D	52	72	10	SWNE	PUD	IRR	Supplemental Ditch	EDNA N. GATCH	05/10/1916	EAST CREEK
C23/044A	52	72	10	SWSW	ADJ	IRR	Grant No. 1 Ditch	John J. Grant	08/12/1905	Springs

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C23/045A	52	72	10	SWSW	PUD	IRR	Grant No. 2 Ditch	John J. Grant	08/12/1905	Springs
C23/045A	52	72	10	SWSW	ADJ	IRR	Grant No. 2 Ditch	John J. Grant	08/12/1905	Springs
P6856D	52	72	10	SWSW	ADJ	IRR	Grant No. 2 Ditch	JOHN J. GRANT	08/12/1905	Springs
P6855D	52	72	10	SWSW	ADJ	IRR	Grant No. 1 Ditch	JOHN J. GRANT	08/12/1905	Springs
C13/044A	52	72	11	NWSE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	11	SWSE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	11	SESE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C37/363A	52	72	12	NWNW	PU	IRR,RES	Bull Creek Reservoir	W. J. Monnett	05/19/1914	Bull Creek
C37/363A	52	72	12	NWNW	PUO	IRR,RES	Bull Creek Reservoir	W. J. Monnett	05/19/1914	Bull Creek
C37/364A	52	72	12	NWNW	PUD	IRR,RES	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
C38/234A	52	72	12	NWNW	PUD	IRR	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
P2658R	52	72	12	NWNW	ADJ	IRR,DOM	Bull Creek Reservoir	WALTER J. MONNETT	05/19/1914	Bull Creek
P12415D	52	72	12	NWNW	ADJ	IRR,DOM	Monnett Ditch	WALTER J. MONNETT	05/19/1914	Bull Creek
C38/234A	52	72	12	NWSW	ADJ	IRR	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
P21266D	52	72	12	NWSW	PUD	IRR	Wood No. 1 Sprinkler Irrigation System	ROBERT M. & GEORGIA MARY C. WOOD	08/27/1953	Little Powder River
P21266D	52	72	12	NWSW	DSC	IRR	Wood No. 1 Sprinkler Irrigation System	ROBERT M. & GEORGIA MARY C. WOOD	08/27/1953	Little Powder River
P12415D	52	72	12	NWSW	ADJ	IRR,DOM	Monnett Ditch	WALTER J. MONNETT	05/19/1914	Bull Creek
C13/044A	52	72	14	NENE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	14	NWNE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	14	SWNE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	14	SENE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C72/199A	52	72	14	SWNW	ADJ	IRR	P.L.R. Spreader System	D. C. Holler and Jane Holler, husband and wife	05/10/1974	Hay Creek
P24338D	52	72	14	SWNW	ADJ	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C13/044A	52	72	14	SENW	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C72/199A	52	72	14	SENW	ADJ	IRR	P.L.R. Spreader System	D. C. Holler and Jane Holler, husband and wife	05/10/1974	Hay Creek
C72/199A	52	72	14	SENW	ADJ	IRR	P.L.R. Spreader System	D. C. Holler and Jane Holler, husband and wife	05/10/1974	Hay Creek
C72/199A	52	72	14	SENW	PUD	IRR	P.L.R. Spreader System	D. C. Holler and Jane Holler, husband and wife	05/10/1974	Hay Creek
P24338D	52	72	14	SENW	PUD	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek
P24338D	52	72	14	SENW	ADJ	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek
P24338D	52	72	14	SENW	ADJ	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek
C13/044A	52	72	14	NESW	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C72/199A	52	72	14	NESW	ADJ	IRR	P.L.R. Spreader System	D. C. Holler and Jane Holler, husband and wife	05/10/1974	Hay Creek
P24338D	52	72	14	NESW	ADJ	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek
P24338D	52	72	14	NWSW	ADJ	IRR	P.L.R. Spreader System	D. C. HOLLER	05/10/1974	Hay Creek
C13/044A	52	72	14	NESE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
P14204D	52	72	14	NESE	PUD	IRR	Ben Hur Ditch	BEN HUR STOCK FARM	01/13/1916	Corrall Creek
C13/044A	52	72	14	NWSE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	14	SWSE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	14	SESE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C23/044A	52	72	15	NWNW	ADJ	IRR	Grant No. 1 Ditch	John J. Grant	08/12/1905	Springs
C23/045A	52	72	15	NWNW	ADJ	IRR	Grant No. 2 Ditch	John J. Grant	08/12/1905	Springs
P6856D	52	72	15	NWNW	ADJ	IRR	Grant No. 2 Ditch	JOHN J. GRANT	08/12/1905	Springs
P6855D	52	72	15	NWNW	ADJ	IRR	Grant No. 1 Ditch	JOHN J. GRANT	08/12/1905	Springs
P11599R	52	72	16	SENW	UNA	IND	Sedemintation No. 33 Reservoir	TRITON COAL COMPANY** WY State Lands & Investments	07/21/2003	Main Branch Hay Creek
P11598R	52	72	16	SWSE	UNA	IND	Sedimentation No. 34 Reservoir	TRITON COAL COMPANY** WY State Lands & Investments	07/21/2003	Hay Creek

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P11602R	52	72	18	SENE	UNA	IND	Hay Creek Blocking Dike Reservoir	Triton Coal Co.** Wyo State Office of Lands & Investments	07/21/2003	Main Branch Hay Creek
P11602R	52	72	18	SENE	UNA	IND	Hay Creek Blocking Dike Reservoir	Triton Coal Co.** Wyo State Office of Lands & Investments	07/21/2003	Main Branch Hay Creek
31/1/11S	52	72	18	NENW	UNA	STO	Franklin #1 Stock Reservoir	Redstone Resources, Inc.**BYRON F OEDEKOVEN	12/04/2001	
31/5/82S	52	72	18	NWSW	UNA	STO	FRANKLIN #2 STOCK RESERVOIR	BYRON F OEDEKOVEN** Redstone Resources	04/25/2002	
30/5/223S	52	72	19	NWNW		STO	Z-24 #2 Stock Reservoir	Byron F. Oedekoven	01/19/2001	
C34/176A	52	72	20	SENE	PU	IRR,DOM	Grant Reservoir	John J. Grant	06/12/1909	Hay Creek
P24874D	52	72	20	SESE	PUD	OIL,TEM, IND,DRI	C & K Petroleum, Inc. Oil Well Pump Point	C & K PETROLEUM, INC.	10/29/1975	C & K Spring
C34/177A	52	72	21	NWNE	ADJ	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
P11598R	52	72	21	NWNE	UNA	IND	Sedimentation No. 34 Reservoir	TRITON COAL COMPANY** WY State Lands & Investments	07/21/2003	Hay Creek
C34/177A	52	72	21	NENW	ADJ	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
C34/177A	52	72	21	NWNW	ADJ	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
C34/176A	52	72	21	SWNW	PU	IRR,DOM	Grant Reservoir	John J. Grant	06/12/1909	Hay Creek
C34/176A	52	72	21	SWNW	PUO	IRR,DOM	Grant Reservoir	John J. Grant	06/12/1909	Hay Creek
C34/177A	52	72	21	SWNW	ADJ	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
C34/177A	52	72	21	SWNW	PUD	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
C34/177A	52	72	21	SENW	ADJ	IRR,DOM	Grant Ditch	John J. Grant	06/12/1909	Hay Creek
P24874D	52	72	21	SWSW	PU	OIL,TEM, IND,DRI	C & K Petroleum, Inc. Oil Well Pump Point	C & K PETROLEUM, INC.	10/29/1975	C & K Spring
P24874D	52	72	21	SWSW	DSC	OIL,TEM, IND,DRI	C & K Petroleum, Inc. Oil Well Pump Point	C & K PETROLEUM, INC.	10/29/1975	C & K Spring

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C13/044A	52	72	23	NENE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	23	NWNE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C34/179A	52	72	23	SWNE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	SWNE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C13/044A	52	72	23	SENE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	23	NENW	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C34/179A	52	72	23	SENW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	SENW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	23	NESW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	NESW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	23	SESW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	SESW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C13/044A	52	72	23	NESE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C34/179A	52	72	23	NESE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	NESE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	23	NWSE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	NWSE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	23	SWSE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	23	SWSE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C13/044A	52	72	23	SESE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C34/179A	52	72	23	SESE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
C13/044A	52	72	26	NENE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C13/044A	52	72	26	NWNE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C34/179A	52	72	26	NWNE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	NWNE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C13/044A	52	72	26	SWNE	ADJ	IRR	Preston Ditch	Mike Elmore	9/6/1890	Little Powder River
C34/179A	52	72	26	SWNE	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	SWNE	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	26	NENW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	NENW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	26	SWNW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	SWNW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	26	SENW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	SENW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
C34/179A	52	72	26	NWSW	ADJ	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
P6887D	52	72	26	NWSW	UNA	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
P6758S	52	72	27	NENW	PU	STO	South Pines Stock Reservoir	CHARLES R. OEDEKOVEN	07/24/1970	South Pines Draw
P6758S	52	72	27	NENW	PUO	STO	South Pines Stock Reservoir	CHARLES R. OEDEKOVEN	07/24/1970	South Pines Draw
C38/038A	52	72	27	SESE	ADJ	IRR	Rawhide Ditch {Enl. of}	Lydia H. Elmore	06/01/1914	Rawhide Creek
C38/043A	52	72	27	SESE	ADJ	IRR	Rawhide Ditch No. 2	Lydia H. Elmore	06/01/1914	Rawhide Creek
P12472D	52	72	27	SESE	ADJ	IRR	Rawhide Ditch No. 2	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P2971E	52	72	27	SESE	ADJ	IRR	Rawhide Ditch {Enl. of}	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P12410R	52	72	31		UNA	STO	Triton No. 1 Reservoir	Quantum Energy/Blackstone	12/28/2005	Living Water Draw
P12410R	52	72	31	NESW	UNA	STO	Triton No. 1 Reservoir	Quantum Energy/Blackstone	12/28/2005	Living Water Draw
P17232S	52	72	31	SWSW	UNA	STO	Joe LeFors Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Living Water Draw
P12410R	52	72	31	SESW	UNA	STO	Triton No. 1 Reservoir	Quantum Energy/Blackstone	12/28/2005	Living Water Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C36/250A	52	72	33	SENW	PUD	IRR	Road Ditch	Effie Rooney	05/24/1912	Road Draw
C36/250A	52	72	33	NWSW	ADJ	IRR	Road Ditch	Effie Rooney	05/24/1912	Road Draw
C34/182A	52	72	33	SWSW	PUD	IRR	Rough Ditch	William D. Rooney	05/24/1912	Rough Draw
P11276D	52	72	33	SWSE	PUD	IRR	Rough Ditch	WM. D. ROONEY	05/24/1912	Rough Draw
C38/043A	52	72	34	NENE	ADJ	IRR	Rawhide Ditch No. 2	Lydia H. Elmore	06/01/1914	Rawhide Creek
P12472D	52	72	34	NENE	ADJ	IRR	Rawhide Ditch No. 2	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
C38/038A	52	72	34	NWNE	ADJ	IRR	Rawhide Ditch {Enl. of}	Lydia H. Elmore	06/01/1914	Rawhide Creek
P2971E	52	72	34	NWNE	ADJ	IRR	Rawhide Ditch {Enl. of}	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
C34/178A	52	72	34	SWNE	PUO	IRR	Raw-Hide Reservoir	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
C34/178A	52	72	34	SWNE	PU	IRR	Raw-Hide Reservoir	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
C34/179A	52	72	34	SWNE	PUD	IRR	Raw-Hide Ditch	Mrs. Lydia H. Elmore	09/20/1905	Rawhide Creek
C38/038A	52	72	34	SWNE	PUD	IRR	Rawhide Ditch {Enl. of}	Lydia H. Elmore	06/01/1914	Rawhide Creek
C38/039A	52	72	34	SWNE	PUO	IRR	Rawhide Reservoir,, Enl.	Lydia H. Elmore	06/01/1914	Rawhide Creek
C38/039A	52	72	34	SWNE	PU	IRR	Rawhide Reservoir,, Enl.	Lydia H. Elmore	06/01/1914	Rawhide Creek
P734R	52	72	34	SWNE	PUO	IRR	Raw-Hide Reservoir	MIKE ELMORE	09/20/1905	Rawhide Creek
P734R	52	72	34	SWNE	PU	IRR	Raw-Hide Reservoir	MIKE ELMORE	09/20/1905	Rawhide Creek
P6887D	52	72	34	SWNE	PUD	RES,IRR	Raw-Hide Ditch	MIKE ELMORE	09/20/1905	Rawhide Creek
P2971E	52	72	34	SWNE	PUD	IRR	Rawhide Ditch {Enl. of}	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P2971E	52	72	34	SWNE	PUH	IRR	Rawhide Ditch {Enl. of}	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P2681R	52	72	34	SWNE	PU	IRR	Rawhide Reservoir,,Enlarge	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P2681R	52	72	34	SWNE	PUO	IRR	Rawhide Reservoir,,Enlarge	LYDIA H. ELMORE	06/01/1914	Rawhide Creek
P15503S	52	73	1	SESE	UNA	STO	Hall-Tate #6 Stock Reservoir	David & Rhoda Tate** QUANTUM ENERGY	09/07/2001	Hulaman Gulch
P18370S	52	73	1		UNA	STO	Hall-Tate #4 Stock Reservoir	David & Rhoda Tate	09/13/2001	Aloha Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P6121S	52	73	1	SWNW	PU	STO	South Pasture Stock Reservoir	DEAN W. HALL	07/31/1967	Muman Draw
P6121S	52	73	1	SWNW	PUO	STO	South Pasture Stock Reservoir	DEAN W. HALL	07/31/1967	Muman Draw
P6121S	52	73	1	NESW	PU	STO	South Pasture Stock Reservoir	DEAN W. HALL	07/31/1967	Muman Draw
P6121S	52	73	1	NWSW	PU	STO	South Pasture Stock Reservoir	DEAN W. HALL	07/31/1967	Muman Draw
P16540S	52	73	2	SESE	UNA	STO	Redtail Stock Reservoir	David and Rhoda Tate** Redstone Resources	04/19/2002	Luow Gulch
P16540S	52	73	2	SWSE	UNA	STO	Redtail Stock Reservoir	David and Rhoda Tate** Redstone Resources	04/19/2002	Luow Gulch
P15431S	52	73	2	NENE	UNA	STO	Hall-Tate #7 Stock Reservoir	Devon Energy Production**David & Rhoda Tate	10/12/2001	Hall-Tate Draw
P15431S	52	73	2	NWNE	UNA	STO	Hall-Tate #7 Stock Reservoir	Devon Energy Production**David & Rhoda Tate	10/12/2001	Hall-Tate Draw
P18352S	52	73	3		UNA	STO	Soukup Draw PR-3 Stock Reservoir	William A. Paul & Elizabeth Landeck	02/12/2007	Will's Gulch
P16362S	52	73	3	SWSE	UNA	STO	Landeck #10 Stock Reservoir	Devon Energy Prod. Co.**William A. Landeck	04/19/2002	East McKay Draw
P16362S	52	73	3	NESE	UNA	STO	Landeck #10 Stock Reservoir	Devon Energy Prod. Co.**William A. Landeck	04/19/2002	East McKay Draw
CR7/063A	52	73	3	SWNE	PU	STO	McKay Stock Reservoir	William A. Landeck	09/07/1971	East McKay Draw
P7138S	52	73	3	SWNE	PU	STO	McKay Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East McKay Draw
P12795R	52	73	3	SWNE	UNA	STO	Enl of McKay Reservoir	William Landeck	09/13/2001	East McKay Draw
CR7/062A	52	73	3	NESW	PUO	STO	Robinson #1 Stock Reservoir	William A. Landeck	09/07/1971	West McKay Draw
CR7/062A	52	73	3	NESW	PU	STO	Robinson #1 Stock Reservoir	William A. Landeck	09/07/1971	West McKay Draw
P7136S	52	73	3	NESW	PU	STO	Robinson #1 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	West McKay Draw
P7136S	52	73	3	NESW	PUO	STO	Robinson #1 Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	West McKay Draw
CR7/063A	52	73	3	NWSE	PU	STO	McKay Stock Reservoir	William A. Landeck	09/07/1971	East McKay Draw
CR7/063A	52	73	3	NWSE	PUO	STO	McKay Stock Reservoir	William A. Landeck	09/07/1971	East McKay Draw
P7138S	52	73	3	NWSE	PU	STO	McKay Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East McKay Draw
P7138S	52	73	3	NWSE	PUO	STO	McKay Stock Reservoir	WILLIAM A. LANDECK	09/07/1971	East McKay Draw
P12795R	52	73	3	NWSE	UNA	STO	Enl of McKay Reservoir	William Landeck	09/13/2001	East McKay Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P16325S	52	73	10	NWNE	UNA	STO	Rosalie Kenney Stock Reservoir	Helen 1987 Trust Hinkes** Twenty Mile Land Co.	11/15/2002	Soakup Creek
P16325S	52	73	10	SENE	UNA	STO	Rosalie Kenney Stock Reservoir	Helen 1987 Trust Hinkes** Twenty Mile Land Co.	11/15/2002	Soakup Creek
P16325S	52	73	10	NENE	UNA	STO	Rosalie Kenney Stock Reservoir	Helen 1987 Trust Hinkes** Twenty Mile Land Co.	11/15/2002	Soakup Creek
P16363S	52	73	10	NWNE	UNA	STO	Landeck #11 Stock Reservoir	Devon Energy Prod. Co.**William A. Landeck	04/19/2002	Sponge Draw
P16363S	52	73	10	SWNE	UNA	STO	Landeck #11 Stock Reservoir	Devon Energy Prod. Co.**William A. Landeck	04/19/2002	Sponge Draw
P16482S	52	73	11	NESW	UNA	STO	Edward B. Kenny Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Malachi Draw
P1168S	52	73	12	SESE	PU	STO	Lake Stock Reservoir	CECLE COOK	03/07/1955	Hay Creek Draw
P1168S	52	73	12	SESE	PUO	STO	Lake Stock Reservoir	CECLE COOK	03/07/1955	Hay Creek Draw
30/4/222S	52	73	12	SESE		STO	Cook #2 Stock Reservoir	Cecle Cook	01/19/2001	
CU9/110A	52	73	13	NWSW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	SESW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	NESW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	SWSW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	NWSW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	SESW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	NESW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	13	SWSW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
30/5/222S	52	73	13	SENE		STO	Cook #3 Stock Reservoir	Cecil Cook	01/19/2001	

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P5468S	52	73	13	NWNW	PU	STO	Cook #2 Stock Reservoir	CECLE L. COOK	11/15/1965	Cook Draw
P5468S	52	73	13	NWNW	PUO	STO	Cook #2 Stock Reservoir	CECLE L. COOK	11/15/1965	Cook Draw
P17744S	52	73	13	NESW	UNA	STO	Oedy #1 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Oedy Draw
P17744S	52	73	13	NESW	UNA	STO	Oedy #1 Stock Reservoir	Byron F. Oedekoven	01/19/2001	Oedy Draw
P16541S	52	73	14	SWNE	UNA	STO	Stanley A. Soukup #2 Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/08/2002	Carlson Draw
P16541S	52	73	14	NWNE	UNA	STO	Stanley A. Soukup #2 Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/08/2002	Carlson Draw
P16478S	52	73	15	NWNE	UNA	STO	Stanley A. Soukup Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Soakup Creek
P16478S	52	73	15	SENE	UNA	STO	Stanley A. Soukup Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Soakup Creek
P16478S	52	73	15	NENE	UNA	STO	Stanley A. Soukup Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Soakup Creek
P16542S	52	73	22	NESE	UNA	STO	William R. Fox #1 Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	05/09/2002	Squarepants Gulch
P16542S	52	73	22	NWSE	UNA	STO	William R. Fox #1 Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	05/09/2002	Squarepants Gulch
P16479S	52	73	22	NENE	UNA	STO	Martin P. Carlson Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Triton Draw
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23		ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
P16479S	52	73	23	NWNW	UNA	STO	Martin P. Carlson Stock Reservoir	Devon Energy Prod. Co.** Twenty Mile Land Co.	04/25/2002	Triton Draw
CU9/110A	52	73	23	SWNE	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	23	SWNE	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	24	NENW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
CU9/110A	52	73	24	NENW	ADJ	MISC	MOREL #1	Green Valley Estates Improvment and Service District	04/14/1993	
P17743S	52	73	24	NWNE	UNA	STO	Z-24 #3 Stock Reservoir	Byron F. Oedekoven** Quantum Energy/Blackstone	01/19/2001	Outer Draw
30/4/223S	52	73	24	NWSE		STO	Z-24 #1 Stock Reservoir	Byron F. Oedekoven	01/19/2001	
P17509S	52	73	26	NESW	UNA	STO	Bond Stock Reservoir	Calvin & Della Bond	05/09/2002	Kelley Draw
P3997S	52	73	26	NWSW	PU	STO	Kelley Stock Reservoir	HERMAN COLE	01/03/1962	Kelley Draw
P3997S	52	73	26	NWSW	PUO	STO	Kelley Stock Reservoir	HERMAN COLE	01/03/1962	Kelley Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
P17231S	52	73	26	SESW	UNA	STO	John Schwartz #2 Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Kelley Draw
P18099S	52	73	27	NESW	UNA	STO	William R. Fox #2 Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Road Creek Prong of Wild Cat Creek
P16006S	52	73	34	SENE	UNA	STO	Ray T. Varah #1 Stock Reservoir	Devon Energy Production Co., LP** Twenty Mile Land Co.	04/25/2002	Isaiah Draw
P16006S	52	73	35	SWNW	UNA	STO	Ray T. Varah #1 Stock Reservoir	Devon Energy Production Co., LP** Twenty Mile Land Co.	04/25/2002	Isaiah Draw
P17231S	52	73	35	NWNE	UNA	STO	John Schwartz #2 Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Kelley Draw
P13241S	52	73	35	SWNE	UNA	STO	John Schwartz Stock Reservoir	TWENTY MILE LAND COMPANY	09/20/1999	J.S. Draw
P17231S	52	73	35	NENW	UNA	STO	John Schwartz #2 Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Kelley Draw
P17233S	52	73	35	SENW	UNA	STO	Ray T. Varah #2 Stock Reservoir	Twenty Mile Land Co., LLC	02/01/2002	J.S. Draw
P18478S	52	73	36	NESW	UNA	STO	Enl N.W. Chassell Reservoir (P1223R) Stock Reservoir	Twenty Mile Land Co.** Wyo State Office of Lands & Investments	09/08/2000	Sage Hen Draw
P13242S	52	73	36	NWSW	UNA	STO	Horse Pasture #2 Stock Reservoir	TWENTY MILE LAND COMPANY	09/20/1999	J.S. Draw
C29/389A	52	73	36	SESW	PU	STO	N. W. Chassell Reservoir	N. W. Chassell	03/07/1908	Sage Hen Draw
C29/389A	52	73	36	SESW	PUO	STO	N. W. Chassell Reservoir	N. W. Chassell	03/07/1908	Sage Hen Draw
P1223R	52	73	36	SESW	PU	STO,DOM	N. W. Chassell Reservoir	N. W. CHASSELL	03/07/1908	Sage Hen Draw
P1223R	52	73	36	SESW	PUO	STO,DOM	N. W. Chassell Reservoir	N. W. CHASSELL	03/07/1908	Sage Hen Draw
P18478S	52	73	36	NWSE	UNA	STO	Enl N.W. Chassell Reservoir (P1223R) Stock Reservoir	Twenty Mile Land Co.** Wyo State Office of Lands & Investments	09/08/2000	Sage Hen Draw
P18478S	52	73	36	SWSE	UNA	STO	Enl N.W. Chassell Reservoir (P1223R) Stock Reservoir	Twenty Mile Land Co.** Wyo State Office of Lands & Investments	09/08/2000	Sage Hen Draw
C34/182A	51	72	3	NWNW	ADJ	IRR	Rough Ditch	William D. Rooney	05/24/1912	Rough Draw
P11276D	51	72	3	NWNW	ADJ	IRR	Rough Ditch	WM. D. ROONEY	05/24/1912	Rough Draw
C34/182A	51	72	4	NENE	ADJ	IRR	Rough Ditch	William D. Rooney	05/24/1912	Rough Draw
P11276D	51	72	4	NENE	ADJ	IRR	Rough Ditch	WM. D. ROONEY	05/24/1912	Rough Draw

Appropriation	T	R	S	QQ	Status	Permit Uses	Permit Facility name	Permit Applicant	Permit Priority	Permit Source
C34/182A	51	72	4	NWNE	ADJ	IRR	Rough Ditch	William D. Rooney	05/24/1912	Rough Draw
P11276D	51	72	4	NWNE	ADJ	IRR	Rough Ditch	WM. D. ROONEY	05/24/1912	Rough Draw
CU2/553A	51	72	5	SENE	PU	STO	JOHN #2	Carter Oil Company	11/15/1972	
CU2/553A	51	72	5	SENE	PUW	STO	JOHN #2	Carter Oil Company	11/15/1972	
P17232S	51	72	6		UNA	STO	Joe LeFors Stock Reservoir	Twenty Mile Land Co., LLC	04/25/2002	Living Water Draw
P13752S	51	73	1	SWSW	UNA	STO	T51NR73W1SWSW Stock Reservoir	TWENTY MILE LAND COMPANY	01/27/2000	Board Draw
P13751S	51	73	2	NWNE	UNA	STO	T51NR73W2NWNE Stock Reservoir	TWENTY MILE LAND COMPANY	01/27/2000	Board Draw
P29316D	53	72	35	SWNE	DSC	OIL,TEM, IND,DRI	Royal Federal 35-7 Water Haul	CONLEY P. SMITH	02/24/1986	COAL MINE DRAW
C38/234A	52	72	12	NENW	ADJ	IRR	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
P12415D	52	72	12	NENW	ADJ	IRR,DOM	Monnett Ditch	WALTER J. MONNETT	05/19/1914	Bull Creek
C38/234A	52	72	12	SENW	ADJ	IRR	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
P21266D	52	72	12	SENW	PUD	IRR	Wood No. 1 Sprinkler Irrigation System	ROBERT M. & GEORGIA MARY C. WOOD	08/27/1953	Little Powder River
P12415D	52	72	12	SENW	ADJ	IRR,DOM	Monnett Ditch	WALTER J. MONNETT	05/19/1914	Bull Creek
C38/234A	52	72	12	NESW	ADJ	IRR	Monnett Ditch	W. J. Monnett	05/19/1914	Bull Creek
P12415D	52	72	12	NESW	ADJ	IRR,DOM	Monnett Ditch	WALTER J. MONNETT	05/19/1914	Bull Creek

T = township; R = range; S = section; QQ = quarter-quarter; UNA = unadjudicated; PU = location of well (not actual status); PUO = Point of reservoir outlet (not actual status); DSC = description; PUH/PUD = point of diversion/not actual status; ADJ = adjudication; PUW = Location of well (not actual status); STO = stock; DOM = domestic; CBNG = coal bed natural gas; MON = monitoring; MIS/MISC = miscellaneous; IND = industrial; IRR = irrigation; RES = reservoir; OIL = oil refining/production; TEM = temporary filing; DRI = drilling; TD = total depth; SWL = static water level

APPENDIX H

ENVIRONMENTAL QUALITY COUNCIL RULING RESPECTIVE OF HAY CREEK TRACT AS AN ALLUVIAL VALLEY FLOOR

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BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

FILED

FEB 14 2002

Terri A. Lorenzon, Director
Environmental Quality Council

IN THE MATTER OF)
TRITON COAL COMPANY, LLC,)
BUCKSKIN MINE,) Docket No. 01-4602
PERMIT NO. 500-T6, TFN 3 5/322)

APR 2002
Received
Dept. of Envir. Quality
Sheridan

ORDER

On September 17 and 18, 2001, the Environmental Quality Council ("Council") held a public hearing to reconsider a determination by the Department of Environmental Quality ("DEQ"), Land Quality Division ("LQD") that an alluvial valley floor, as defined by Wyo. Stat. 35-11-103(e)(xviii), exists on the Hay Creek Tract of the Buckskin Mine permit area, in Campbell County, near Gillette, Wyoming. Triton Coal Company, LLC, was represented by Edward W. Harris and Jerrold A. Long of Holland & Hart, and the DEQ was represented by John Burbridge, Assistant Attorney General. Council members present at the hearing were Robert Rawlings, Hearing Examiner, Thomas Dunn, Lisa Lindemann, Olin Sims, Jason Shogren, and Wendy Hutchinson. Also present for the Council was Terri A. Lorenzon, attorney for the Council.

On September 18, 2001, the Council, by a unanimous vote of the Council members, reached a decision in this matter. The Council hereby issues the following findings of fact and conclusions of law.

Findings of Fact

1. Triton Coal Company, LLC (Triton) owns and operates the Buckskin coal mine located in Campbell County, near Gillette, Wyoming.

2. On November 10, 2000, Triton applied for a permit amendment to extend the Buckskin Mine into the Hay Creek Tract. Prior to submitting that application, Triton requested a pre-application determination, pursuant to Wyoming Coal Rules and Regulations, Chap. 3, Section 2(a), of the presence of alluvial valley floors in the Hay Creek Tract.

3. After reviewing the material submitted by Triton with respect to the Hay Creek Tract, the LQD determined that 33.55 acres along Hay Creek constituted an alluvial valley floor (AVF).

4. Triton filed a petition with the Council on March 15, 2001, to review the decision of the LQD that 33.55 acres of AVF were present within Triton's mine permit area.

Page 1 of 4

5. The Act defines an AVF as: " the unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities [.]" Wyo. Stat. § 35-11-1-3(e)(xviii).

6. The 33.55 acres determined by the LQD to constitute an AVF are underlain by unconsolidated stream laid deposits and sufficient water is present for subirrigation.

7. Regulations adopted by the LQD to implement the provisions of the Act define "subirrigation or flood irrigation agricultural activities" as follows:

   > 'Subirrigation or flood irrigation agricultural activities' means the past and present *use* of any tract of land *for the successful production* of animal or vegetable life, *based on regional agricultural practices*, where *the use is enhanced or facilitated* by subirrigation or flood irrigation. These *uses include*, but are not limited to, the pasturing, *grazing*, and the cropping, cultivation, or harvesting *of agriculturally useful plants* whose production is enhanced or facilitated by the availability of water from subirrigation or flood irrigation. These uses do not include agricultural practices which do not benefit from the availability of water from subirrigation or flood irrigation.' (*emphasis added*)
   >
   > Wyoming Coal Rules and Regulations, Chapter 1, Section (co).

8. The 33.55 acres consist of riparian bottomland habitat, dominated by wetland plant species. The predominant plant species in this area are prairie cordgrass (*Spartina pectinata)*, common spikesedge (*Eleocharis palustris)*, and American bulrush (*Scirpus pungens poly*). These plants provide poor to fair livestock forage while the vegetation in the upland and lowland prairie habitats provide forage of higher overall quality than that present in these riparian bottomlands.

9. The Hay Creek Tract consists of undeveloped rangeland, where the primary use is grazing cattle. The regional agricultural practice in the area is to place cattle in large fenced pastures that consist of upland and lowland prairie habitats, with access to small riparian areas to ensure water availability. The ranchers in this area do not attempt to specially manage the riparian areas separately from the other habitats.

10. Evidence shows cattle will over-utilize upland and lowland habitats before grazing the riparian plant species listed in paragraph 8 above. Therefore, based on past and present use of this land and regional agricultural practices, the riparian bottomland species are not agriculturally useful plants.

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Conclusions of Law

1. Surface Coal mining in Wyoming is governed by the Wyoming Environmental Quality Act ("Act"). Wyo. Stat. § 35-11-101, *et seq.*

2. The Council has jurisdiction over the parties to and the subject matter of this proceeding. Wyo. Stat. § 35-11-112.

3. The Act requires surface coal mines to obtain permits from DEQ. Wyo. Stat. § 35-11-401(d).

4. The Act contains specific provisions and requirements with respect to areas called alluvial valley floors and the Council has adopted regulations governing alluvial valley floors. Wyo. Stat. §35-11-103(e)(viii); Wyoming Coal Rules and Regulations, Chapt. 1, Section 2(co) and Chapt. 3, Section 2.

5. For a streambed to be designated an alluvial valley floor, it must contain three components: First, the streambed in question must overlie unconsolidated stream laid deposits. Second, there must be sufficient water to provide for flood irrigation or subirrigation. Finally, that flood irrigation or subirrigation must enhance or facilitate past or present use, based on regional agricultural practices.

6. After conducting an exhaustive review of the facts and law during the contested case hearing, the Council concludes that the 33.55 acres the DEQ determined constitute an alluvial valley floor do not enhance or facilitate the past or present use, based on regional agricultural practices. Therefore, the 33.55 acres do not constitute an alluvial valley floor as that term is defined in the applicable statutes and regulations, and Triton should not be required to satisfy those statutory and regulatory requirements that pertain to alluvial valley floors.

ORDER

The decision of the Department of Environmental Quality designating the 33.55 acres in the Hay Creek Tract as an alluvial valley floor is overturned.

IT IS SO ORDERED THIS 11 day of February, 2002.

APR 2002 Received Dept of Envir Quality Sheridan

Robert Rawlings

Robert Rawlings, Hearing Examiner
ENVIRONMENTAL QUALITY COUNCIL
Herschler Bldg., Rm. 1714
122 West 25th Street
Cheyenne, WY 82002
Tel: (307) 777-7170
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CERTIFICATE OF SERVICE

I, Terri A. Lorenzon, certify that at Cheyenne, Wyoming, on the 14th day of February 2002, I served a copy of the foregoing ORDER by depositing copies of the same in the United States mail, postage prepaid, duly enveloped and addressed .o:

Edward W. Harris
Jerrold A. Long
HOLLAND & HART LLP
2515 Warren Avenue, Suite 450
Cheyenne, WY 82001

and also to the following persons via interoffice mail:

Dennis Hemmer, Director
Department of Environmental Quality
122 W. 25th Street, Herschler Building
Cheyenne, WY 82002

Rick Chancellor, Administrator
Land Quality Division
122 W. 25th Street, Herschler Bldg.
Cheyenne, WY 82002

John Burbridge
Senior Assistant Attorney General
Dept. of Environmental Quality-LQD
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Cheyenne, WY 82002

APR 2002
Received
Dept. of Envir. Quality
Sheridan

Terri A. Lorenzon

Terri A. Lorenzon, Esq.
Director

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APPROVED JUN 13 '02

APPENDIX I

BIOLOGICAL ASSESSMENT

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APPENDIX I: BIOLOGICAL ASSESSMENT

Introduction

On March 24, 2006, Kiewit filed an application with the Bureau of Land Management (BLM) under the 43 Code of Federal Regulations (CFR) 3425 (Leasing on Application) to lease federal coal reserves in the Hay Creek II lease by application (LBA) tract (Proposed Action). The Hay Creek II LBA tract is located northwest of and immediately adjacent to existing coal leases at the Buckskin Mine, in northern Campbell County, Wyoming (map I-1).

The physical areas discussed in this assessment are defined as follows:

- proposed tract—the Hay Creek II LBA tract as applied for (419 acres)
- BLM study area—proposed tract plus lands added by the BLM for the analysis process (1,883 acres)
- general analysis area—the maximum area of potential surface disturbance (2,847 acres) that would result from leasing the largest possible tract; the entire BLM study area (includes 0.25-mile-wide buffer)[1].

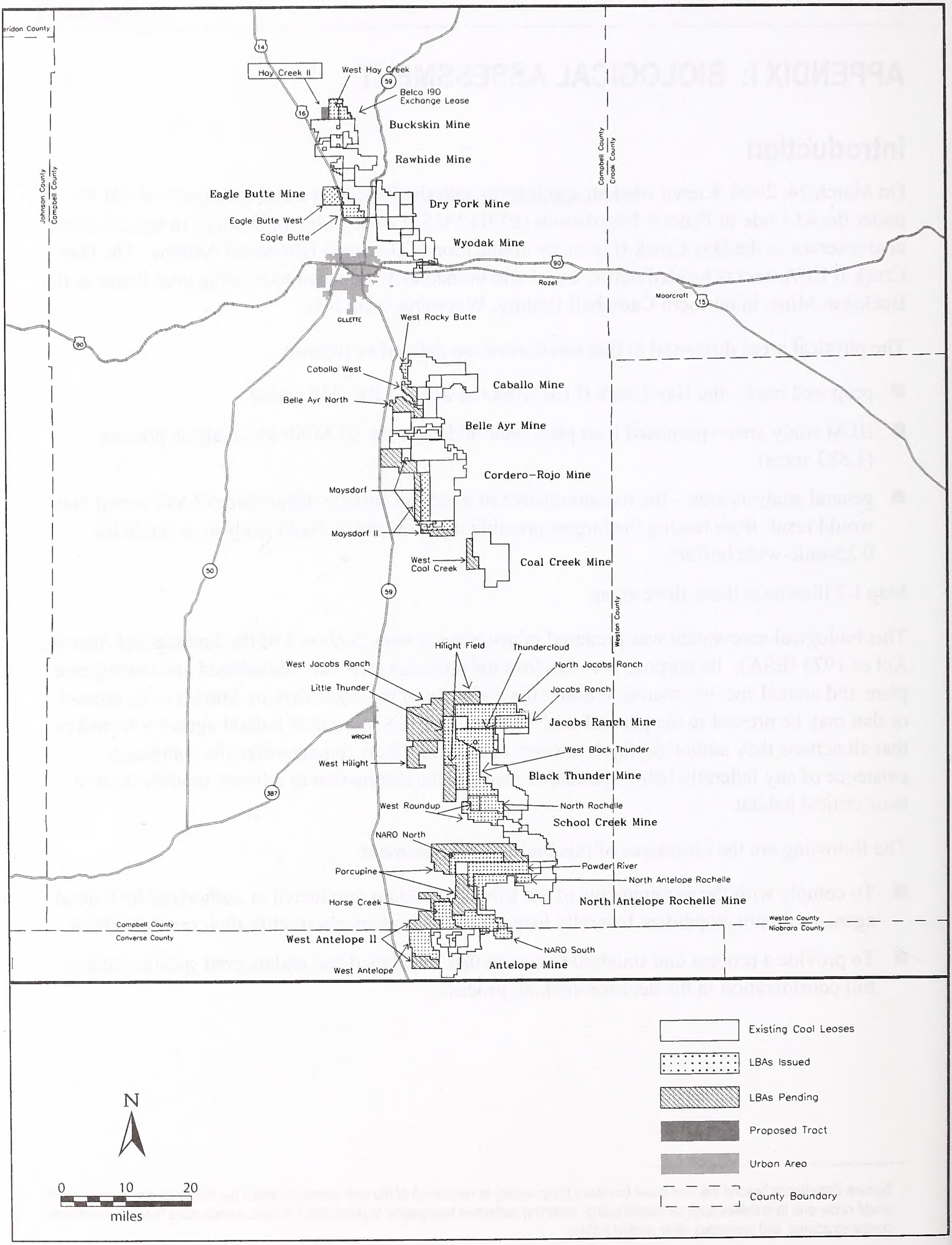
Map I-2 illustrates these three areas.

This biological assessment was prepared in accordance with Section 7 of the Endangered Species Act of 1973 (ESA). Its purpose is to disclose the potential effects on threatened and endangered plant and animal species, managed under the authority of the ESA, that are known to be present or that may be present in the general analysis area. The ESA requires federal agencies to ensure that all actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any federally listed species, or result in the destruction or adverse modification of their critical habitat.

The following are the objectives of this biological assessment:

- To comply with the requirements of the ESA that actions conducted or authorized by federal agencies do not jeopardize federally listed species or adversely modify their critical habitat.
- To provide a process and standard to ensure that threatened and endangered species receive full consideration in the decision-making process.

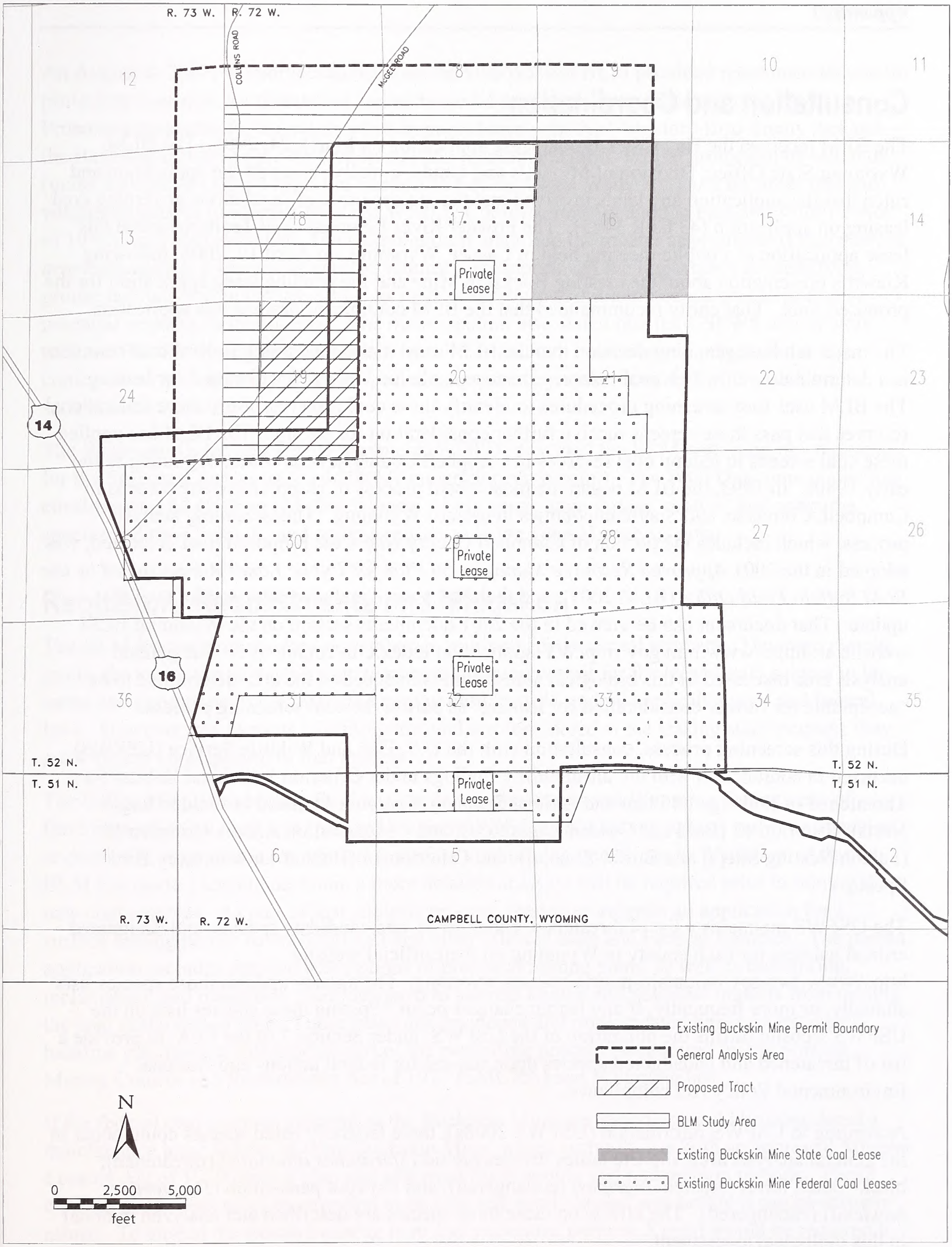
[1] Surface disturbance beyond the final lease boundary is necessary to recover all of the coal resources within the final tract configuration, and would occur due to activities such as overstripping, matching reclaimed topography to premining contours, constructing flood and sediment control structures, and numerous other related actions



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map I-1

General Location Map with Federal Coal Leases and LBA Tracts



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map I-2
General Analysis Area

Consultation and Coordination

The BLM received the Hay Creek II coal lease application on March 24, 2006. The BLM, Wyoming State Office, Division of Minerals and Lands, initially reviewed the application and ruled that the application and lands involved met the requirements of regulations governing coal leasing on application (43 CFR 3425). The Powder River Regional Coal Team reviewed this lease application at a public meeting held in Casper, Wyoming, on April 19, 2006, following Kiewit's presentation about the existing Buckskin Mine and the pending lease application for the proposed tract. That entity recommended that the BLM continue to process this application.

The major land use planning decision that the BLM must make concerning federal coal resources is a determination of which coal reserves are acceptable for further consideration for leasing. The BLM uses four screening procedures to identify these coal reserves. Only those federal coal reserves that pass these screens receive further consideration for leasing. The BLM has applied these coal screens to federal coal reserves in Campbell County several times, beginning in the early 1980s. In 1993, the BLM began the most recent process of reapplying these screens in Campbell, Converse, and Sheridan counties in eastern Wyoming. This screening analysis process, which includes the portion of Campbell County where the proposed tract is located, was adopted in the 2001 *Approved Resource Management Plan for Public Lands Administered by the BLM Buffalo Field Office* (BLM 2001), and the results were included as appendix D of that update. That document can be viewed in the 2001 documents section on the Wyoming BLM website at: http://www.blm.gov/rmp/WY/application/index.cfm/rmpid=101. The general analysis area discussed in this biological assessment is included in the area determined to be "acceptable for further consideration for leasing" as part of the coal screening process.

During this screening process, consultation with the U.S. Fish and Wildlife Service (USFWS) occurred in conjunction with the unsuitability findings under Criterion 9 (Critical Habitat for Threatened or Endangered Plant and Animal Species), Criterion 11 (Bald or Golden Eagle Nests), Criterion 12 (Bald and Golden Eagle Roost and Concentration Areas), Criterion 13 (Falcon Nesting Site[s] and Buffer Zone[s]), and Criterion 14 (Habitat for Migratory Bird Species).

The USFWS maintains a list of threatened, endangered, and candidate species, and designated critical habitats for each county in Wyoming on their official website: http://www.fws.gov/mountain-prairie/species/wyoming. The agency updates those species lists annually, or more frequently, if any listing changes occur. Posting these species lists on the USFWS website fulfills the obligation of the USFWS, under Section 7 of the ESA, to provide a list of threatened and endangered species upon request for federal actions and National Environmental Policy Act compliance.

According to USFWS information (USFWS 2008a), three federally listed species could occur in the general analysis area: the Ute ladies'-tresses orchid (*Spiranthes diluvialis*) (threatened); black-footed ferret (*Mustela nigripes*) (endangered); and blowout penstemon (*Penstemon haydenii*) (endangered). The effects on these three species are described and analyzed in detail in this biological assessment.

An August 8, 2007, memorandum between the USFWS and BLM provided recommendations for protective measures for threatened and endangered species in accordance with the ESA. Protective measures for migratory birds in accordance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and recommendations for the protection of wetlands (under Executive Order 11990 and Section 404 of the Clean Water Act) and for other fish and wildlife resources (under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956) were also included. The memorandum identified the greater sage-grouse (*Centrocercus urophasianus*) as a species of specific interest and emphasized the importance of identifying grouse habitats within the lease area, as well as appropriate mitigation measures to minimize potential impacts on this species. The memorandum also stated that the USFWS would work with the BLM to ensure that the species-specific protective measures and programs for the conservation and recovery of listed species as required by under Section 7 of the ESA are satisfied and carried out.

The Wyoming Game and Fish Department (WGFD) provided the BLM with scoping comments for the Proposed Action in April 2007 (Emmerich pers. comm.). The WGFD recommended that consideration be given to possible impacts on big game, sage-grouse, raptors, and nongame species and their habitats, and aquatic resources in the general analysis area.

Regulatory Requirements and Mitigation

The BLM leasing process does not authorize mining of federal coal reserves. The lease merely grants the lessee the exclusive right to pursue a mining permit for the leased tract subject to the terms and conditions of the lease, the mining permit itself, and all applicable state and federal laws. However, the impacts of mining the coal are considered at the leasing stage because they are a logical consequence of that process.

The Office of Surface Mining Reclamation and Enforcement and Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) are the federal and state agencies, respectively, responsible for regulating surface coal mining operations in Wyoming. After the BLM has made a leasing decision, a more detailed analysis will be required prior to mining the new coal reserves. As part of that analysis process, the lessee submits an application for a surface mining permit to WDEQ/LQD and other affected state and Federal agencies. The permit application includes detailed descriptions of proposed mining plans, as well as monitoring, reclamation, and mitigation plans designed to address known and potential impacts from mining the coal in the leased tract. Those plans are developed and implemented based on extensive baseline information collected as part of the permitting process, as required by the Surface Mining Control and Reclamation Act of 1977 (SMCRA) and Wyoming law.

If the federal coal reserves adjacent to the Buckskin Mine are leased, it would be considered a maintenance lease for the existing Buckskin Mine, which currently has both an approved Mineral Leasing Act of 1920 mining plan and approved State mining and reclamation permits. Those existing documents must be amended to include any newly leased area before it can be actively mined. To amend the existing mining plan and associated permits, Kiewit would be required to

submit a detailed permit application package to WDEQ/LQD as described above. The proposed mining, monitoring, reclamation, and mitigation plans for the new lease area must be approved by multiple state and federal agencies, including the USFWS, before a permit to mine new coal reserves is issued. Those approval documents are included in WDEQ/LQD's review process to ensure the permit application is complete and complies with the permitting requirements, and that the coal mining operation will meet the performance standards of the approved Wyoming program. If the permit application package does comply with the numerous and stringent requirements, WDEQ/LQD would issue an amended permit to the applicant that would allow the permittee to extend coal mining operations into the newly acquired lease area.

Protection of fish, wildlife, and related environmental values is required under SMCRA regulations at 30 CFR 816.97, which state:

> No surface mining activity shall be conducted which is likely to jeopardize the continued existence of endangered or threatened species listed by the Secretary of which is likely to result in the destruction or adverse modification of designated critical habitats of such species in violation of the Endangered Species Act of 1973, as amended.

To comply with this regulation, Section 7 Consultation would be required before amendments to the existing mining and reclamation plan are approved to add the newly acquired lease area. That consultation process occurs at the permitting stage because specific details regarding the actual location of the disturbance areas in the new lease area, how and when they would be disturbed, and how they would be reclaimed are not available at the leasing stage. If the USFWS deems it appropriate, additional measures to ensure compliance with the ESA and SMCRA can be developed at that time based on potential impacts on listed species from proposed mining operations in the new lease area.

The following is a partial list of measures related to federally-protected species that are required as part of the mining and reclamation permits:

- avoiding bald eagle (*Haliaeetus leucocephalus*) disturbance per the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act;
- restoring bald eagle foraging areas disturbed by mining;
- using raptor safe power lines; and
- surveying for Ute ladies'-tresses and other listed plant species if habitat is present.

In addition to disallowing any surface mining activity that is likely to jeopardize the continued existence of endangered or threatened species, SMCRA regulations at 30 CFR 816.97:

- require the operator to minimize disturbances and adverse impacts on fish, wildlife, and other related environmental values; and
- require that the operator use the best technology currently available to:
  - minimize electrocution hazards to raptors;

- locate and operate haul and access roads to avoid or minimize impacts on important fish and wildlife species; and
- design fences, conveyors, and other potential barriers to permit passage of large mammals.

Description of the Proposed Action and Alternatives

The Proposed Action

Under the Proposed Action, the BLM would hold a competitive sale and would issue a lease for the federal coal reserves included in the proposed tract. The Proposed Action assumes that Kiewit would be the successful bidder and would incorporate the proposed tract into its existing mine operations. The Proposed Action would not expand operations at the Buckskin Mine, but would maintain current levels of production for an additional period of time. The facilities and infrastructure would be the same as those currently identified in the WDEQ/LQD Mine Permit 500 Term T7, approved May 22, 2006, and the *BLM Resource Recovery and Protection Plan*, approved June 16, 2006 (BLM 2006).

The legal description of the proposed tract is provided in table I-1. The entire surface of the existing Buckskin Mine permit area and general analysis area is privately owned by individuals or companies, while most of the subsurface minerals (all of the coal and the majority of oil and gas reserves) are federally owned. All oil and gas production facilities located in the general analysis area are privately owned.

Table I-1. Legal Description of Proposed Tract

Campbell County, Wyoming, Sixth Principal Meridian Township 52 North, Range 72 West		Acres
Section 19:	Lot 5 (W ½)	20.71
	Lot 6	41.42
	Lot 7	42.45
	Lot 10	42.31
	Lot 11	41.68
	Lot 12 (W ½)	20.84
	Lot 13(W ½)	20.935
	Lot 14	41.75
	Lot 15	41.90
	Lot 18	41.97
	Lot 19	42.01
	Lot 20 (W ½)	21.065
Total Acres		**419.04**

The proposed tract includes approximately 419.04 acres. As discussed previously, it is assumed that an area larger than the proposed tract would be disturbed to allow recovery of all coal resources. Therefore, approximately 478 acres, including a buffer area north of the proposed tract, would be disturbed to recover the coal reserves within the proposed tract under this alternative. Surface disturbance beyond the proposed lease boundary would be due to activities such as overstripping, matching reclaimed topography to premining contours, constructing flood- and sediment-control structures, and numerous other related operations.

Much of the western boundary of the proposed tract is adjacent to Campbell County Road 23 (Collins Road). In accordance with SMCRA, and as specified under unsuitability criterion 3 (43 CFR 3461), lands within 100 feet of the outside line of the right-of-way of a public road are considered unsuitable for surface coal mining. Consequently, the coal reserves underlying the Collins Road, its right-of-way, and an associated 100-foot buffer zone cannot be accessed under current conditions unless Kiewit pursues an exception to this prohibition and the Campbell County Board of Commissioners allows the public road to be relocated or closed. Neither the applicant nor the commissioners has submitted a proposal to move this road, and Kiewit does not anticipate pursuing that option.

Alternative 1 (No Action)

Under Alternative 1, the No Action Alternative, Kiewit's application to lease the coal included in the proposed tract would be rejected: federal coal reserves adjacent to the existing Buckskin Mine would not be offered for competitive sale, and the additional coal would not be mined. However, selection of this alternative would not preclude Kiewit or another company from submitting a future lease application for these adjacent coal reserves.

Under Alternative 1, currently permitted mining activities associated with existing coal leases at the Buckskin Mine would not be affected. The facilities, infrastructure, employment levels, and reclamation efforts under this alternative would be the same as those currently identified in the WDEQ/LQD Mine Permit 500 Term T7, approved May 22, 2006, and the *BLM Resource Recovery and Protection Plan*, approved June 16, 2006 (BLM 2006). Approximately 182 acres of the proposed tract and 436.5 additional acres of the BLM study area (618.5 total acres) overlap the existing permit boundary. Therefore, under the No Action Alternative, surface disturbance would occur in this overlap area, but would be limited to highwall reduction, topsoil removal, and other mine support activities related to mining under the existing contiguous leases. Average annual production would continue as described under the Proposed Action.

Alternative 2

Under Alternative 2, the BLM would hold a competitive sale and would issue a lease for the federal coal reserves included in an alternative tract configuration. The alternative tract configuration would be defined by the BLM from lands within the BLM study area (map I-2) to be technically, economically, and environmentally preferable to the proposed tract. The alternative tract configuration could be smaller than the proposed tract, or include part or all of the BLM study area.

As under the Proposed Action, Alternative 2 assumes that Kiewit would be the successful bidder and would incorporate the alternative tract configuration into its existing mine operations. Alternative 2 would not expand operations at the Buckskin Mine, but would maintain current levels of production for an additional period of time.

Table I-2 provides the legal description of the BLM study area.

Table I-2. Legal Description of BLM Study Area

Campbell County, Wyoming, Sixth Principal Meridian Township 52 North, Range 72 West	Acres
Section 7: Lots 17 through 20	166.91
Section 8: Lots 13 through 16	162.00
Section 9: Lots 13 through 15	120.58
Section 17: Lots 1 through 4, 5 (N. ½), 6 (N. ½), 7 (N. ½), and 8 (N. ½)	247.39
Section 18: Lots 5 through 11, 12 (N. ½, SW. ¼), 13 (W. ½), 14 through19, and 20 (W. ½)	612.95
Section 19: Lots 5 (W. ½), 6 through 11, 12 (W. ½), 13 (W. ½), 14 through 19, and 20 (W. ½)	573.27
Total Acres	**1,883.10**

Not all of the coal included in the proposed tract and BLM study area is considered mineable at present. An occupied residence and a portion of the Collins and McGee roads overlie some of the coal included under Alternative 2. As discussed under the Proposed Action, SMCRA prohibits mining within 100 feet on either side of the right-of-way of any public road (43 CFR 3461); the same prohibition applies to lands within 300 feet of an occupied residence. Kiewit is not considering acquiring the surface rights to the occupied residence, and has not applied to relocate either of the county roads. Consequently, additional coal reserves between the two roads would not be disturbed if the coal under the roads was not mined. Although the federal coal underlying the county road right-of-way and associated buffer zones may not be mined, it is included in the analysis because it would allow maximum recovery of the mineable coal adjacent to, but outside of the rights-of-way and associated buffer zones.

If a decision is made to hold a competitive lease sale, and if the sale has a successful bidder, a lease would be issued for federal coal reserves within the final tract delineation, as determined by the BLM. It is assumed that the applicant would be the successful bidder at the lease sale. The final tract configuration offered for lease would be subject to standard and special lease stipulations developed for the Wyoming Powder River Basin (PRB).

One stipulation developed for the Wyoming PRB relating to threatened and endangered species is presented below:

> THREATENED, ENDANGERED, CANDIDATE, or OTHER SPECIAL STATUS PLANT and ANIMAL SPECIES – The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened or endangered under the

Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., or that have other special status. The Authorized Officer may recommend modifications to exploration and development proposals to further conservation and management objectives or to avoid activity that will contribute to a need to list such species or their habitat or to comply with any biological opinion issued by the Fish and Wildlife Service for the Proposed Action. The Authorized Officer will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act. The Authorized Officer may require modifications to, or disapprove a proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species, or result in the destruction or adverse modification of designated or proposed critical habitat.

The lessee shall comply with instructions from the Authorized Officer of the surface managing agency (BLM, if the surface is private) for ground disturbing activities associated with coal exploration on federal coal leases prior to approval of a mining and reclamation permit or outside an approved mining and reclamation permit area. The lessee shall comply with instructions from the Authorized Officer of the Office of Surface Mining Reclamation and Enforcement, or his designated representative, for all ground disturbing activities taking place within an approved mining and reclamation permit area or associated with such a permit.

General Setting

The terrain in the general analysis area consists primarily of gently sloping uplands and relatively level agricultural fields, with more rugged terrain in the northeastern portion of the area. Elevations in the general analysis area range from approximately 4,080 to 4,380 feet above mean sea level.

Predominant wildlife habitat types classified in the general analysis area broadly correspond with the major plant communities defined during the vegetation baseline study. The proposed tract is dominated (approximately 71%) by various upland grassland habitats. Habitats in the general analysis area are comprised primarily (71%) of upland grasslands (approximately 40%) and agricultural lands (croplands and pastures, 31%). No sand dunes or prairie dog colonies are present in the general analysis area.

No major drainages pass through the proposed tract itself, though a closed, unnamed drainage system crosses its northwestern corner. Hay Creek flows from west to east through the northern half of the general analysis area, with a considerable portion passing through the existing Buckskin Mine permit area. Several primary and secondary tributaries are also in that area. Under natural conditions, Hay Creek and all tributaries in the area are considered ephemeral (i.e., respond only to rainfall or snowmelt events). The determination of stream classification was made using the flume monitoring data collected by the Buckskin Mine and reported in the existing permit document.

The National Wetland Inventory (NWI) mapping system shows several wetlands occurring in the general analysis area (USFWS 2007). Many of these areas correspond with wetlands and other waters of the U.S. that were identified during previous wetland delineations of the Buckskin Mine; however, some of the information shown on these maps is relatively old and does not reflect current conditions. Based on the NWI maps, approximately 64.44 acres of wetlands have been identified in the general analysis area. Of these, 30.7 acres were determined to be potentially jurisdictional wetlands based on field observations; the remaining 33.74 acres were initially determined to be nonjurisdictional non-wetlands (e.g., borrow pits, old impoundments) or no longer present. The majority of the potential jurisdictional wetlands were associated with Hay Creek and other ephemeral tributaries in the general analysis area. Some wetlands previously mapped on the NWI may have been altered due to agricultural uses and permitted mine disturbance or water production related to coal bed natural gas (CBNG) production in the general analysis area.

Wetlands occur in a variety of forms in the general analysis area, with palustrine wetlands being the most common and abundant. Palustrine wetlands are defined by their close association with emergent herbaceous marshes, swales, or wet meadows and are supported by saturated soils along the banks of the drainages (Cowardin et al. 1979). Wetlands support a variety of vegetation types and occur mainly along drainages in the general analysis area. Hydrology for these areas is provided primarily by surface runoff from adjacent uplands and discharged CBNG waters.

Hay Creek, which flows primarily from the west to east, and several other tributaries that generally flow into Hay Creek, are waters of the U.S. These tributaries are primarily intermittent stream channels, open water, and other stream channels that carry water but do not meet the criteria for classification as wetlands. The Buckskin Mine's approved mining plan allows disturbance of a portion of the Hay Creek channel. Beginning in 2006, approximately 1.75 miles of the channel were diverted into the Hay Creek Diversion to facilitate mining in the northern extent of the existing Buckskin Mine permit area; the diversion runs through the overlap between the general analysis area and the existing permit area.

Soils in the general analysis area consist mainly of loams, sandy loams, and some clay loams. One hydric soil unit, Felix Clay, is located in the general analysis area (NRCS 2008), on slopes ranging from 0 to 2% and in soils that are developing in alluvium derived from sandstone and shale on gently sloping uplands.

CBNG discharge water has increased the frequency and duration of streamflow events in some portions of the general analysis area. The USFWS NWI maps (2007) show one small wetland (a 0.24-acre diked impoundment) in the extreme northwestern corner of the proposed tract; however, field observations over the years have indicated that it is wet primarily during early spring months. A second NWI inventoried wetland (0.24 acre) in the buffer area north of the proposed tract would be affected by disturbance associated with mine support activities such as topsoil stripping and stockpiling. One playa and one small instream impoundment are in the northwestern portion of the surrounding general analysis area. Those features are also seasonal,

with water typically present in spring but dry by mid- to late summer. The playa is the only water body in the general analysis area that provides habitat for waterfowl, shorebirds, and other aquatic species. Due to its limited availability, it serves primarily as a staging area during spring migrations. Due to the lack of permanent water sources, the general analysis area does not support any fisheries.

A wide variety of existing mine facilities, operations, and reclamation activities are present in the overlap between the general analysis area and existing Buckskin Mine permit area, and throughout the permit area itself. Facilities present include storage silos, coal crushing and preparation plants, a railroad spur and loading facility, among others. Mining activities involve a variety of heavy equipment operations that occur 24 hours per day every day of the year; blasting occurs during daylight hours on a nearly daily basis. Reclamation efforts also involve heavy equipment. Disturbance and reclamation activities occur incrementally through the area. Because the mine operates at night, artificial lighting is present in active pit areas and on haul roads to ensure the safety of mine employees.

General Survey Requirements and History

The BLM Data Adequacy Standards for the Powder River Coal Region (BLM 1987) describe the minimum data requirements needed to make coal leasing recommendations within the PRB Coal Production Region. Because most coal mines in the PRB have collected long-term annual monitoring data for both vertebrates and plants as part of their WDEQ/LQD permit requirements, and because most surveys include lands outside the current permit area, the BLM typically accepts that annual monitoring information as meeting the minimum requirements of these standards. The long-term (25 years) database available for vertebrate species in the Buckskin Mine permit area and surrounding lands meets those minimum requirements. Vegetation monitoring and surveys have also been conducted over multiple years, though such surveys are typically limited to the permit area or proposed expansion area and a 0.25-mile-wide buffer.

Due to their proximity to the existing Buckskin Mine permit area, the entire proposed tract and the southern third (33%) of the general analysis area have been included in annual wildlife surveys for the last 25 years (1984 through 2008). Approximately 95% of the general analysis area has been surveyed annually for the last seven years (2002 through 2008) in conjunction with a previous permit amendment at the mine. The entire general analysis area and expanded adjacent lands were included in targeted baseline surveys conducted for the LBA process from late 2007 through 2008.

Threatened and Endangered Species

No "critical" habitat designated by the USFWS for threatened and endangered species is present in the general analysis area or the surrounding vicinity. The following discussion describes species' habitat requirements and their occurrence in the general analysis area, and evaluates the potential environmental effects of the action alternatives on federal threatened and endangered species.

Additional detailed information on the affected environment in the general analysis area as well as long-term results from annual monitoring in the vicinity are provided in the Vegetation Data Report and Wildlife Data Report. Those reports can be viewed at the BLM Wyoming High Plains District Office in Casper, Wyoming.

Threatened Species

Ute Ladies'-Tresses Orchid (Spiranthes diluvialis)

The Ute ladies'-tresses, a member of the orchid family, was listed as threatened on January 17, 1992, due to a variety of factors, including habitat loss and modification, hydrological modifications of existing and potential habitat areas, and invasion of exotic plant species. At the time of listing, this species was only known from Colorado, Utah, and extreme eastern Nevada. Ute ladies'-tresses orchids were discovered in Wyoming in 1993. It is currently known from western Nebraska, eastern Wyoming, north-central Colorado, northeastern and southern Utah, east-central and southeastern Idaho, southwestern Montana, and central Washington.

Biology and Habitat Requirements

The Ute ladies'-tresses is a perennial, terrestrial orchid with erect, glandular-pubescent stems 8 to 20 inches tall arising from tuberous-thickened roots. In Wyoming, this species typically blooms from late July or early August to early September, with fruits produced from mid-August to September (Fertig 2000). Ute ladie's-tresses can only be reliably located and positively identified when they are flowering (Heidel 2001). The flowers are white or ivory and clustered into a spike at the top of the stem; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October (Heidel 2007). Plants probably do not flower every year and may remain dormant below ground during drought years. In general, the species' best flowering years seem to correspond with extreme heat during flowering. Preliminary review of climate data also indicates that growing seasons that start out as relatively cold and wet correspond with low flowering levels (Heidel 2001).

The Ute ladies'-tresses orchid is commonly associated with horsetail, milkweed, verbena, blue-eyed grass, reedgrass, goldenrod, bentgrass and arrowgrass. Wyoming populations often occur in moist meadow communities dominated by redtop, common quackgrass, Baltic rush, foxtail barley, or switchgrass within a narrow vegetative band between emergent aquatic vegetation and dry upland prairie (Fertig 2000). Vegetative cover tends to range from 75% to 90% and is usually less than 45 centimeters tall (Fertig 2000). However, the orchid seems intolerant of shade and is usually found as small scattered groups that occupy relatively small areas of open vegetation within the riparian system. Populations are often dynamic and "move" within a watershed as disturbances create new habitat or succession eliminates old habitat (Fertig and Beauvais 1999). The orchid is well adapted to disturbances from stream movement and is tolerant of other disturbances, such as grazing, that are common to grassland riparian habitats (USFWS 1995). Ute ladies'-tresses colonize early successional riparian habitats such as point bars, sand bars, and low-lying gravelly, sandy, or cobbley edges, persisting in those areas where the hydrology provides continual dampness in the root zone through the growing season. Soils

where the orchid has been found typically range from fine alluvial silt/sand to gravels and cobbles, as well as in highly organic and peaty soil types, or whitish loamy clay with a slightly basic pH. The orchid can also become established in heavily disturbed sites, such as revegetated gravel pits, heavily grazed riparian edges, and along well-traveled foot trails on old berms (USFWS 1995). This species is not found in heavy or tight clay soils or in extremely saline or alkaline soils.

Affected Environment

The total known number of individuals of this species is currently estimated to be 83,000 individuals (Fertig et. al. 2005). Occurrences range in size from one plant to a few hundred individuals. Prior to 2005, four orchid populations had been documented within Wyoming, all discovered between 1993 and 1997 (Fertig and Beauvais 1999). Four additional sites were located in 2005 and one additional site was found in 2006 (Heidel 2007). The new locations were in the same drainages or tributaries as the original four populations. Drainages with documented orchid populations include Antelope Creek and tributaries in northern Converse County, Bear Creek in northern Laramie and southern Goshen Counties, Horse Creek in Laramie County, and Niobrara River in Niobrara County. No occurrences have been recorded in Campbell County. The nearest documented record of Ute ladie's-tresses is the Antelope Creek population, approximately 70 miles southwest of the general analysis area.

Potential habitat for Ute ladies'-tresses within the general analysis area was identified prior to field work using the U.S. Geologic Survey quadrangle map or aerial photographs. The NWI system was also consulted. Typically, individual polygons were created within each polygon representing a logical sampling unit. Habitat Management, Inc. conducted a survey for the Ute ladies'-tresses orchid on August 28, 2008. LandTrak Resources, Inc. conducted another survey for this species on September 9, 2009. Both surveys were conducted during the official flowering period, as determined by BLM and USFWS biologists. Habitat Management, Inc. conducted similar surveys for this species in portions of the general analysis area in 2004, 2006, and 2007.

The Ute ladies'-tresses orchid occurs primarily in areas where vegetation is relatively open and not overly dense, overgrown, or heavily over-grazed. Particular attention was placed on identifying areas where its preferred vegetation canopy and use conditions are met. A 100% pedestrian survey of the vegetation communities with supporting facultative wet or obligatory wetland plant species within the area was performed. Since this species is commonly associated with grasses, sedges, rushes, shrubs, and riparian trees, the presence or absence of these plant species was noted. In addition, the Ute ladies'-tresses orchid is commonly associated with horsetail, milkweed, verbena, blue-eyed grass, reedgrass, goldenrod, bentgrass and arrowgrass. Observations of those species were also noted since the orchid is commonly found growing in association with them. Areas that receive full sunlight or that are only partially shaded are more likely to support populations of this orchid than deeply shaded sites. Such sites were also noted and recorded during the field surveys.

The presence or absence of potential orchid habitat types was physically confirmed through the field surveys. Wetlands in all areas including all stream channels, alluvial terraces, sub-irrigated meadows, and any other locations where the soil has the potential to be at least temporarily saturated within 18 inches of the surface for at least one week during the growing season were identified, located in the field, and plotted on the site map. Highly disturbed or modified sites, upland sites, sites entirely inundated by standing water, sites with heavy clay soils, and very saline sites were noted and excluded from vegetation in soil analysis, since they do not represent a potential Ute ladies'-tresses habitat. Sites with dense stands of reed canarygrass, greasewood, teasel, and common reed were also excluded from further scrutiny. Areas that support facultative wet or obligatory wetland plant species were identified during the survey.

Most of the potentially suitable habitat in the general analysis area is found along Hay Creek. This primary drainage, which flows generally from west to east through the northern portion of the general analysis area, is classified as an ephemeral stream in this area. Limited portions of Hay Creek and its tributary drainages may receive recharge from bank storage making them locally intermittent. In response to recent surface discharge of groundwater associated with CBNG development on or upstream of the general analysis area, streamflow occurrence is now more persistent and some drainage channels are seldom completely dry.

Several unnamed and named ephemeral tributaries drain portions of the general analysis area though, as described above. Only one drainage intersects the proposed tract itself; that drainage does not connect with Hay Creek. One small (0.24 acre) impoundment is present in the northwestern corner of the proposed tract, with additional stock reservoirs present elsewhere in the general analysis area. The stock reservoirs are constructed as earthen berms or dams located on these ephemeral drainages. These ponds generally contain water only in early spring, then dry up in summer.

Environmental Consequences

Mining the federal coal under the Proposed Action or Alternative 2 will have no effect on Ute ladies'-tresses orchids.

No Ute ladies'-tresses orchids were located during surveys conducted in appropriate habitats within the general analysis area in 2004 or annually from 2006 through 2009 (LandTrak Resources 2009). No potential habitat for this species is present within the proposed tract. Previous wetland inventories identified a total of 6.71 acres of nonjurisdictional wetlands and 1.33 acres of other waters of the U.S. within or directly adjacent to Hay Creek as it flows through the overlap between the existing Buckskin Mine permit area and the general analysis area. However, most of these features have already been excavated for the extraction of coal reserves as part of the current Buckskin Mine permit, or are already permitted for disturbance due to their location within the existing permit area. Additionally, coal reserves under and within 100 feet of the Collins and McGee roads, and within 300 feet of an occupied residence, are considered "unsuitable for mining" under BLM coal unsuitability criterion 3. Because Kiewit has not applied to relocate either road and does not intend to obtain surface rights for the occupied residence, the lands between the two roads and west of the Collins Road are operationally

blocked from mining. Consequently, no new potential Ute ladie's-tresses habitat has been added by the Proposed Action or Alternative 2 that is not already approved for disturbance.

Because this species can persist below or above ground without flowering, single season surveys that meet the current USFWS survey guidelines may not detect populations; surveys in the general analysis area have been conducted during the last four consecutive flowering seasons (2006 through 2009).

Potential habitat for Ute ladies'-tresses is extremely limited within the general analysis area and typically is not suitable for this species for a number of key reasons:

- Wet meadow habitat types typically support aggressive rhizomatous graminoid plant species. These potential habitat sites are well-established plant communities that typically have dense under-story cover. This orchid normally does not grow in such conditions.
- Soils trend from moderately to very saline/sodic. A number of the potential habitat sites have visible saline/sodic crusts. Inland saltgrass and foxtail barley are often the only species growing in these areas.
- CBNG dewatering and treatment activities have caused major impacts to all of the watersheds within the proposed amendment area. Areas that have been historically wet are now dry, and new areas are now wet where CBNG waters are discharged/treated. The historic groundwater and soil moisture conditions have been altered or disrupted and major shifts in plant community distribution have occurred or are occurring.
- Livestock grazing has impacted the quality of riparian areas. Livestock use during the wetter times of the year adversely impacts potential Ute ladies'-tresses habitat.

Stormwater runoff varies considerably from year to year. A reliable supply of surface water is not always available during the middle and late summer to support late growth plant species. This serves to further limit the presence of potential Ute ladies'-tresses habitat within the general analysis area; the quality of potential habitats is extremely poor.

Any jurisdictional wetlands that are destroyed by mining operations would be replaced in accordance with the requirements of Section 404 of the Clean Water Act, as determined by the Corps. The replaced wetlands may not duplicate the exact function and landscape features of the premine wetlands. The Corps considers the type and function of each jurisdictional wetland that will be impacted and may require restoration of additional acres if the type and function of the restored wetlands will not completely replace those of the original wetlands. Replacement of nonjurisdictional and functional wetlands may be required by the surface land owner and/or WDEQ/LQD. That agency allows and sometimes requires mitigation of nonjurisdictional wetlands affected by mining, depending on the values associated with the wetland features. WDEQ/LQD also requires replacement of playas with hydrologic significance.

Cumulative Effects

Alterations of stream morphology and hydrology are believed to have extirpated Ute ladies'-tresses from most of its historical range (USFWS 1995). Disturbance and reclamation of

streams by surface coal mining may alter stream morphology and hydrology. The large quantities of water produced with CBNG development and discharged on the surface may also alter stream morphology and hydrology. However, no typical suitable habitat for Ute ladie's-tresses is present within the proposed tract. Additionally, no orchids have been documented during repeated surveys of typical suitable habitat in the portion of the Hay Creek drainage included in the BLM study area. Furthermore, nearly the entire Hay Creek drainage under that alternative has already been approved for disturbance, and most of that disturbance has already occurred. The remaining drainage reach that may provide typical suitable habitat for this species is within one or more areas designated as unsuitable for mining. Therefore, leasing the federal coal reserves is not likely to contribute to cumulative adverse effects for the Ute ladie's-tresses orchid.

Endangered Species

Black-Footed Ferret (Mustela nigripes)

The black-footed ferret is a nocturnal mammal and an obligate associate of prairie dogs (*Cynomys* spp.). It was listed as endangered in March 1967. This species is thought to have historically inhabited a nearly contiguous matrix of prairie dog colonies spanning the short-grass prairies of the eastern and southern Rockies and the Great Plains of North America (Forrest et al. 1985). Since the early 1930s, numerous factors have led to substantial declines in prairie dog colonies in that region. Reductions in some states are estimated as high as 90% from formerly occupied colonies (Rose 1973; Tyler 1968).

The conversion of grasslands to agricultural landscapes, eradication of prairie dogs, and diseases such as the plague and canine distemper have resulted in severe reductions in prairie dog colonies across the west. Many of those colonies provided food, shelter, and habitat for black-footed ferrets. This species of ferret is currently one of the most endangered mammals in North America and was thought to be extinct until a small population was discovered in Meeteetse, Wyoming, in September 1981. Since then, successful captive breeding and reintroduction programs have released black-footed ferrets back into the wild in several western and Great Plains states including Wyoming, Montana, South Dakota, Colorado, Utah, and Arizona.

Biology and Habitat Requirements

Black-footed ferrets rely on prairie dogs to provide both shelter and food (Hillman and Clark 1980). It is estimated that at least 30 acres of an occupied prairie dog colony are required to persistently support individual ferrets, and 123.5 acres are needed to support breeding females (Forrest et al. 1985). Ferrets produce one litter per year, typically giving birth to four or five kits. The decline in ferret populations has been largely attributed to the reduction in the vast prairie dog colonies that historically existed in the western United States. Reintroduction efforts involving captive-bred individuals have successfully established one black-footed ferret population in the Shirley Basin area in south-central Wyoming. Currently, this is the only known black-footed ferret population within the state, though other populations are present

elsewhere in the United States and Mexico. The Buckskin Mine and Hay Creek II general analysis area are beyond the focus area for ferret reintroduction efforts on the nearby Thunder Basin National Grassland and elsewhere in the general region (USDA Forest Service 2002; Grenier 2003).

Existing Environment

Few ferrets have historically been recorded in locations away from prairie dog colonies. Despite extensive surveys conducted throughout the state over the past 20-plus years, no black-footed ferrets have been documented in Wyoming other than the isolated population discovered in Meeteetse in 1981 (Miller et al. 1996). Those surveys included numerous USFWS-approved clearances conducted by a variety of agency and contract biologists for coal mining and other development in the Wyoming PRB, as well as USDA Forest Service surveys for ferrets on the Thunder Basin National Grassland in northeast Wyoming.

No black-footed ferrets have ever been documented at the Buckskin Mine or in the surrounding region, and no prairie dog colonies are present within the general analysis area. One black-tailed prairie dog (*Cynomys ludovicianus*) colony of approximately 80 acres is located in a narrow valley on the far side of a ridge that marks the northeastern extent of the general analysis area. Another small (less than 10 acres) colony is located approximately 1 mile north of that area. Both colonies were occupied during recent years, but the local landowner occasionally attempts to eradicate them. No other prairie dog colonies are known to be within a larger surrounding complex at this time. Due to the small size and isolated nature of these two colonies, they are not considered as potential black-footed ferret habitat by the USFWS (1989). On February 2, 2004, the USFWS declared that surveys for black-footed ferrets are no longer required in black-tailed prairie dog colonies throughout Wyoming (USFWS 2004).

Environmental Consequences

Mining the federal coal reserves under the Proposed Action or Alternative 2 would have no effect on black-footed ferrets.

Given the documented absence of this species in the region, including the general analysis area (area of maximum potential surface disturbance associated with the leasing action), the lack of potential habitat (prairie dog colonies) in that area, the isolated nature and small size of the two prairie dog colonies in the vicinity of the area, the block clearance from ferret surveys issued by the USFWS for black-tailed prairie dog colonies throughout the entire state, and the location of the general analysis area beyond future reintroduction sites, surface disturbance within the general analysis area will not result in any direct or indirect effects on black-footed ferrets.

Cumulative Effects

As indicated, coal mining and natural gas development have occurred in the general project area for more than 20 years, with energy extraction activities expected to increase in the immediate future. Potential ferret habitat is also affected by impacts on prairie dog populations due to other factors. Plague can infect and eliminate entire prairie dog colonies. Poisoning and recreational

prairie dog shooting may locally reduce prairie dog populations, but seldom completely eliminate colonies.

Nevertheless, due to the lack of ferrets and prairie dog colonies in the general analysis area, leasing and mining the federal coal reserves in the general analysis area would not contribute to cumulative adverse effects to black-footed ferrets in that area or elsewhere in the region. No black-footed ferret populations exist or have ever been documented within northeastern Wyoming. The USFWS issued a block clearance for this species in black-tailed prairie dog colonies throughout the entire state. The Buckskin Mine and general analysis area are beyond the focus area for future ferret reintroduction efforts in the general region (USDA-Forest Service 2002, Grenier 2003). Furthermore, neither the Proposed Action nor Alternative 2 would conflict with any future objectives to manage the area for, or reintroduce black-footed ferrets into, northeast Wyoming.

Blowout Penstemon (Penstemon haydenii)

The blowout penstemon, a member of the figwort family, was listed as endangered on October 1, 1987. It was added to the list of threatened and endangered species for Campbell County in 2008. This species is narrowly endemic to blowouts in sparsely vegetated, shifting sand dunes. The removal of fire, leveling of dunes, reduction of grazing, and cultivation of stabilizing cover crops drastically reduced the amount of habitat available for this species. Loss of habitat, coupled with impacts from insect outbreaks, drought, inbreeding, and potential over collection, has caused problems for the plant (University of Wyoming 2009). Additional threats to the plant may occur when sand dunes are removed or overly disturbed by vehicular traffic (USFWS 2008b).

The current stronghold for this species is in western Nebraska. Approximately 3,500-5,000 plants are currently found in multiple locations in that region. The plant was first discovered in Wyoming in 1877 and then rediscovered in 1996 (BLM 2008). The Wyoming population is limited to three sites in the Ferris dunes in northern Carbon County that contain several thousand plants (BLM 2008); those dunes are more than 225 miles southwest of the general analysis area.

Biology and Habitat Requirements

The blowout penstemon is a perennial forb with stems less than 12 inches tall. The inflorescence is 2 to 6 inches long and has 6 to 10 compact whorls of milky-blue to pale lavender flowers. Flowers typically bloom from mid-June to early-July.

This species requires an early succession habitat in sand blowouts. The plant's current know range in Wyoming is restricted to two habitat types: steep, northwest-facing slopes of active sand dunes with less than 5% vegetative cover; and on north-facing sandy slopes, on the lee side of active blowouts with 25% to 40% vegetative cover (USFWS 2008b).

Affected Environment

The general analysis area is not within the documented historical range of the blowout penstemon in Wyoming. That area is located approximately 170 miles northwest of the known Nebraska sites and approximately 225 miles northeast of the Wyoming occurrences.

Approximately 16% (455 acres) of the general analysis area is identified as Sandy Prairie Grassland and potentially could contain sand dune and blowout features. Therefore, a survey for blowout penstemon was conducted. Potential habitat for this species was identified and divided into logical polygons or sites. Each of these polygons was surveyed for the attributes listed in the USFWS *Penstemon haydenii* memorandum. These attributes include:

- sand dune or blowout features
- disturbed areas of significantly low ground with sand, sandy loam, or loamy sand soils

Portions of the general analysis area are moderately grazed by livestock and some areas have infestations of weedy species such as Canada thistle. Grazed and weedy areas meeting any of the potential habitat conditions for this species noted above were surveyed regardless of grazing use levels or severity of weed infestation.

Habitat Management, Inc. conducted a survey for potential blowout penstemon habitat in the general analysis area in 2008. LandTrak Resources, Inc. conducted two surveys for *Penstemon haydenii*. The first survey was on June 17, 2009, and the second survey was on July 9, 2009. Both of the 2009 surveys were conducted in Sandy Prairie vegetation communities in section 18 and section 19, T52N R72W.

Results of this survey determined that no suitable blowout penstemon habitat is present in the general analysis area; no sand dunes (whether stable or blown out) are currently present in that area. Likewise, no blowout penstemon specimens were found in any of the seven potential 2009 survey sites. The general analysis area is dominated (71%) by upland grasslands and agricultural lands. The graminoid-dominated Sandy Prairie uplands provide significant ground cover that precludes the development of shifting dune features. The soils in the sites surveyed are stable and no blowout features are present. Blowout penstemon remained undetected in southwest Wyoming for many years. This species can potentially remain dormant below ground for several years and thus be undetectable during surveys. However, the probability appears extremely low that this species is present within the general analysis area.

Environmental Consequences

Mining the federal coal reserves under the Proposed Action or Alternative 2 would have no effect on the blowout penstemon.

No specimens of blowout penstemon were found during surveys conducted in the study area in 2008 and 2009. Typical suitable habitat for this species is non-existent in the general analysis area, which makes it highly unlikely that populations have gone undetected. However, should such populations be present, they could be lost to surface disturbing activities if appropriate

habitat were disturbed. Any potential habitat that has not already been surveyed for blowout penstemon within the project area should be identified and surveyed prior to surface mining activities.

The potential habitat where blowout penstemon could occur within the general analysis area is extremely limited and typically not suitable for a number of key reasons:

- The sites present with either dune-like or blowout features within the general analysis area are extremely limited in size, typically less than 0.1 acre.
- The Sandy Prairie Grassland is dominated by graminiod species which provide substantial ground cover and soil stability.
- Graminoid species typically occur in a more advanced successional and site transitional state than blowout penstemon, which is a pioneering species.

Based on the existing characteristics of the general analysis area, further evaluation of the area for this species is likely unwarranted.

Cumulative Effects

This species is potentially vulnerable to habitat loss and degradation resulting from sand mining, water development, energy development, ORV use, and associated destabilization of its sand dune habitat. It also could be vulnerable to negative effects related to the spread of non-native species within its range. As no potential habitat for this species is present within the general analysis area, leasing the federal coal reserves would not contribute to cumulative adverse effects for the blowout penstemon.

Cumulative Impacts

Cumulative impacts are defined under NEPA as the incremental impacts of past, present, and reasonably foreseeable future actions, including the proposed action, conducted by any entity (e.g., federal, state, private). Cumulative impacts on threatened and endangered species and their habitats can result from both direct (physical) and indirect factors.

The net acreage of surface disturbance associated with energy-related activities in the Wyoming PRB has been increasing in recent years due to greater energy demands throughout the country and increasing prices for local energy resources. Existing habitat-disturbing activities in the PRB include: surface coal mining; conventional oil and gas development; CBNG development; uranium mining; sand, gravel, and scoria mining; ranching; agriculture; road, railroad, and power plant construction and operation; recreational activities; and housing (rural and urban) and business development. Mining, construction, agricultural activities, and urban development tend to have more intense impacts on fairly localized areas, while ranching, recreational activities, and oil and gas development (conventional and CBNG) tend to be less intensive but spread over larger areas. Oil and gas development and mining activities have requirements for reclamation of disturbed areas as resources are depleted.

In the short term, these increased activities can result in the potential loss of individuals due to injuries or mortalities, as well as a reduction in the available habitat for threatened and endangered plant and wildlife species. In the long term, habitats will continue to be impacted, but they are also being and will continue to be restored in several areas as reclamation proceeds.

The BLM is in the process of completing a regional technical study of current and proposed or potential development activity in the PRB to help the agency evaluate the impacts of coal development in that area. The *Powder River Basin Coal Review* consists of three tasks:

- Task 1 updates the BLM's 1996 status check for coal development in the PRB;
- Task 2 develops a forecast of reasonably foreseeable development in the PRB through the year 2020; and
- Task 3 predicts cumulative impacts that would be expected to occur as a result of the projected development.

The information about existing development in the following paragraphs is taken from the *Powder River Basin Coal Review* Task 2 report (BLM 2005) and BLM lease records. The completed PRB Coal Review reports can be accessed from the BLM Wyoming web site at http://www.wy.blm.gov/minerals/coal/prb/prbdocs.htm. The project area for Tasks 1 and 2 of the PRB Coal Review encompasses over 8 million acres and includes all of Campbell, Sheridan, and Johnson Counties and the northern portion of Converse County in northeastern Wyoming.

Oil and gas exploration and production have been ongoing in the PRB for more than 100 years. Conventional (non-CBNG) oil and gas fields are, for the most part, concentrated in the central and southern parts of the structural basin. Development of the CBNG resources from the coal beds is a more recent occurrence, with CBNG production in the Wyoming PRB starting in the late 1980s. As of 2003, an estimated 187,761 acres had been disturbed in the coal review project area as a result of oil and gas development activities, but approximately 115,045 acres (61%) of that disturbance has been reclaimed. This includes conventional oil and gas and CBNG wells, and associated facilities and major transportation pipelines.

The BLM estimates that the existing federal coal leases in the Wyoming PRB include approximately 121,185 acres. The currently pending federal coal LBA tracts as applied for (including the proposed tract) include approximately 35,245 additional acres. The majority of the coal in the areas currently permitted for surface coal mining is federal, but state and private leases are also included within some of the existing mine permit areas. All of the current and proposed federal coal leases are concentrated near the outcrop of the Wyodak coal bed, which is located in eastern Campbell County and the extreme northeastern edge of Converse County. That bed includes the Anderson and Canyon coal seams that are within the general analysis area.

As of 2003, the base year for the PRB Coal Review, the surface coal mining operations along the Wyodak outcrop had disturbed approximately 68,794 acres. Approximately 24,097 of those acres of disturbance are occupied by "permanent" mine facilities, such as roads, buildings, coal handling facilities, etc., which are not available for reclamation until after coal mining operations

end. Of the remaining 44,697 acres of disturbance available for reclamation, approximately 21,238 acres (48%) had been reclaimed. The *Powder River Basin Coal Review* identified an estimated 4,891 additional acres of coal-related development disturbance (i.e., coal-fired power plants, railroads, and coal technology projects) as of 2003.

The total estimate of disturbed acreage related to all types of development in the Wyoming PRB in 2003 was 264,704 acres. In addition to coal and oil and gas activities, this total includes disturbance associated with construction of reservoirs and industrial fabrication firms, as well as public and private infrastructure such as highways and roads, government buildings, and residential and commercial real estate development. It should be noted that some of these disturbances overlap one another. In such cases, the disturbance acreage is counted separately under each category, but is not counted twice in determining the total area of disturbance. These disturbances do not have the same reclamation requirements as coal and oil and gas industries.

Cumulative effects would also occur to threatened and endangered plant and wildlife resources as a result of indirect impacts. One factor is the potential import and spread of noxious weeds around roads and facilities. Noxious weeds have the ability to displace native vegetation and hinder reclamation efforts. Control of noxious weeds is addressed in surface coal mining and reclamation plans. If weed mitigation and preventative procedures are applied to all construction and reclamation practices, the impact of noxious weeds on threatened and endangered plants and wildlife would be minimized.

In reclaimed areas, vegetation cover often differs from undisturbed areas. In the case of surface coal mines, re-established vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the species in the approved reclamation seed mixtures are native to the area. Nevertheless, reclaimed areas may not recreate the ecosystem functions served by undisturbed vegetation communities and habitats for many years after reseeding has occurred. For example, species composition, shrub cover, and other habitat characteristics are likely to differ from pre-disturbance vegetation communities and habitats due to the extended time-frame typically necessary for mature shrub communities to become reestablished in mined areas. Invasion by noxious weeds and alteration of vegetation in reclaimed areas has the potential to alter threatened and endangered plant and wildlife habitat composition and distribution, depending on the species listed and their habitat requirements.

To date, no currently listed threatened and endangered species have been documented at any surface coal mine in the Wyoming PRB. However, some adverse effects to future listed and proposed species that could occur as a result of existing and potential activities in the PRB would include direct loss of habitat, indirect loss of habitat due to human and equipment disturbance, and habitat fragmentation. As described above, all existing coal mines in the Wyoming PRB have agency-approved monitoring and mitigation plans in place to protect threatened and endangered species, per SMCRA (at 30 CFR 816.97) and Wyoming State regulations. If a maintenance coal tract is leased under one of the action alternatives considered in this EIS, these permitting requirements would be extended to include mining operations within the new tract, including the development and approval of detailed plans to mine the coal and reclaim the affected areas.

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APPENDIX J

BUREAU OF LAND MANAGEMENT SENSITIVE SPECIES EVALUATION

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APPENDIX J: BUREAU OF LAND MANAGEMENT SENSITIVE SPECIES EVALUATION

Introduction

Each Wyoming Field Office of the Bureau of Land Management (BLM) has a prepared list of sensitive species to focus management efforts towards maintaining habitats important to those species under a multiple use mandate. The authority for this policy and guidance comes from the Endangered Species Act of 1973, as amended; Title II of the Sikes Act, as amended; the Federal Land Policy Management Act of 1976 (43 U.S.C. 1716); Department Manual 235.1.1A; and BLM Manual 6840.06 E. Sensitive Species.

The goals of the sensitive species policy are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems.
- Ensure sensitive species are considered in land management decisions.
- Prevent a need for species listing under the Endangered Species Act.
- Prioritize needed conservation work with an emphasis on habitat.

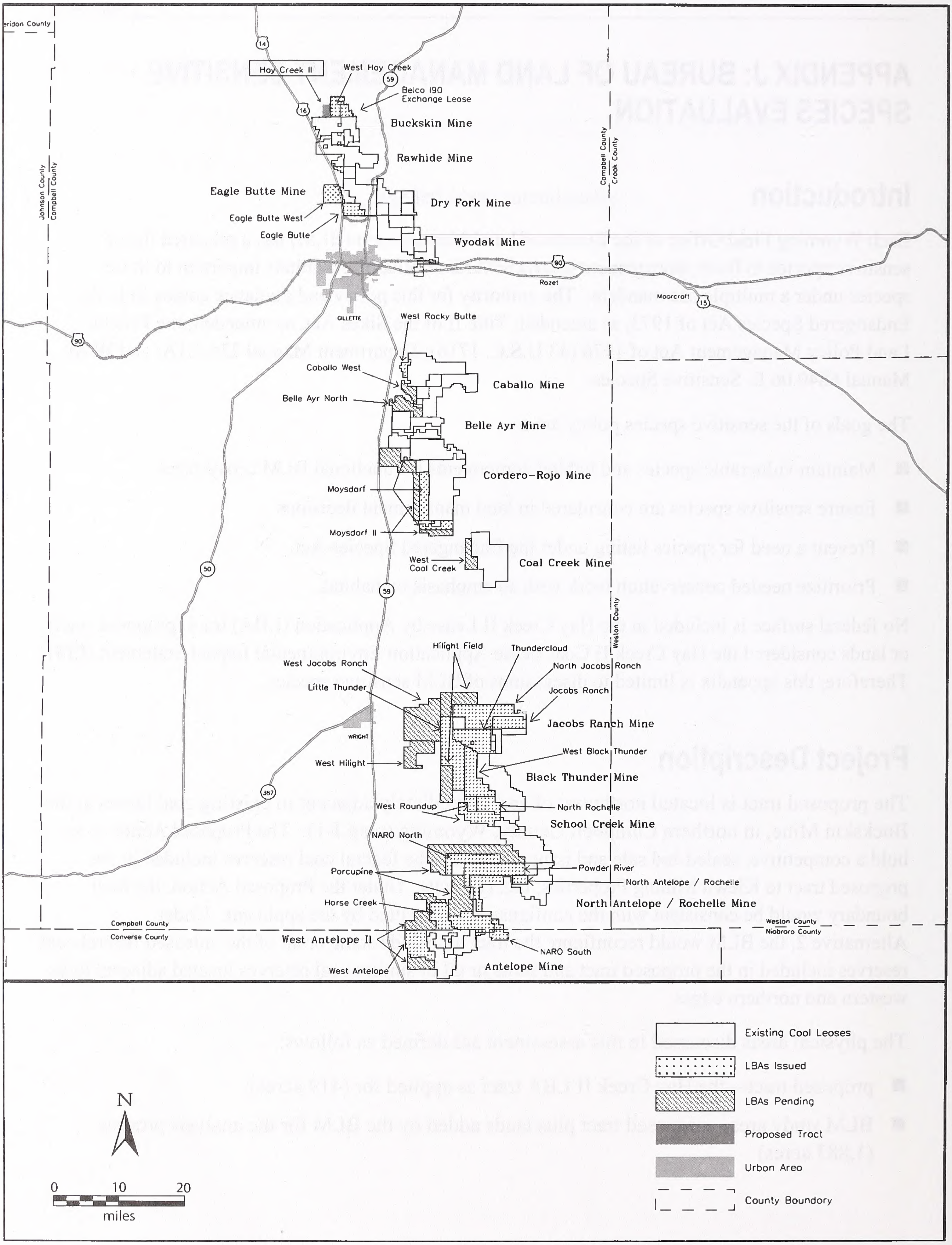
No federal surface is included in the Hay Creek II Lease by Application (LBA) tract (proposed tract) or lands considered the Hay Creek II Coal Lease Application Environmental Impact Statement (EIS). Therefore, this appendix is limited to discussions of BLM sensitive species.

Project Description

The proposed tract is located northwest of and immediately adjacent to existing coal leases at the Buckskin Mine, in northern Campbell County, Wyoming (map J-1). The Proposed Action is to hold a competitive, sealed-bid sale and issue a lease for the federal coal reserves included in the proposed tract to Kiewit Mining Properties, Inc. (Kiewit). Under the Proposed Action, the tract boundary would be consistent with the configuration submitted by the applicant. Under Alternative 2, the BLM would reconfigure the tract to include some or all of the unleased federal coal reserves included in the proposed tract and some or all of similar coal reserves located adjacent to its western and northern edges.

The physical areas discussed in this assessment are defined as follows:

- proposed tract—the Hay Creek II LBA tract as applied for (419 acres)
- BLM study area—proposed tract plus lands added by the BLM for the analysis process (1,883 acres)



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by BLM.

Map J-1

General Location Map with Federal Coal Leases and LBA Tracts

- general analysis area—the maximum area of potential surface disturbance (2,847 acres) that would result from leasing the largest possible tract; the entire BLM study area (includes 0.25-mile-wide buffer)[1].

Map J-2 illustrates these three areas.

These are the only two alternatives considered in the Hay Creek II EIS that are likely to result in the sale and mining of coal reserves in the near future. Both alternatives assume that the applicant would be the successful bidder and that the federal coal reserves would be mined as a maintenance lease for the existing, adjacent Buckskin Mine. The entire surface of the existing Buckskin Mine permit area and general analysis area is privately owned by individuals or companies, while most of the subsurface minerals (all of the coal and the majority of oil and gas reserves) are federally owned. All oil and gas production facilities located in the general analysis area are privately owned.

Species Occurrence and Habitat Descriptions

Due to the location of the general analysis area in northeastern Wyoming, the vertebrate and plant sensitive species lists for the BLM Buffalo Field Office were used as references for the following discussion. Both lists include all species within the range of authority for that field office. The current wildlife list (BLM 2002) can be found on the official Wyoming BLM website: http://www.blm.gov/pgdata/etc/medialib/blm/wy/wildlife.Par.9226.File.dat/02species.pdf. The plant list was updated in November 2008, and can be found at the following web link: http://www.wy.blm.gov/botany/fieldoffices/bfo.htm. Species that have been delisted or removed from the federal listing process under the Endangered Species Act automatically revert to Sensitive Species status for the BLM. Therefore, the black-tailed prairie dog (*Cynomys ludovicianus*), bald eagle (*Haliaeetus leucocephalus*), and mountain plover (*Charadrius montanus*) were added to the 2002 list.

Table J-1 lists the sensitive species, summarizes their habitat requirements, and indicates if they have been observed in the general analysis area. This list was reviewed prior to beginning field surveys. Vertebrate observations were based on annual wildlife monitoring conducted in the overlapping survey area for the Buckskin Mine since 1984, as well as field surveys and file searches completed in 2007 and 2008 specifically for this analysis. Vegetation sampling is also conducted annually in portions of the existing Buckskin Mine permit area, particularly in reclaimed habitats. Baseline surveys have also been completed as the permit area has expanded over the years, with additional targeted surveys conducted for federally listed plants prior to disturbance in some years. Plant surveys related to this analysis were conducted primarily in 2008, with some follow-up surveys conducted in 2009.

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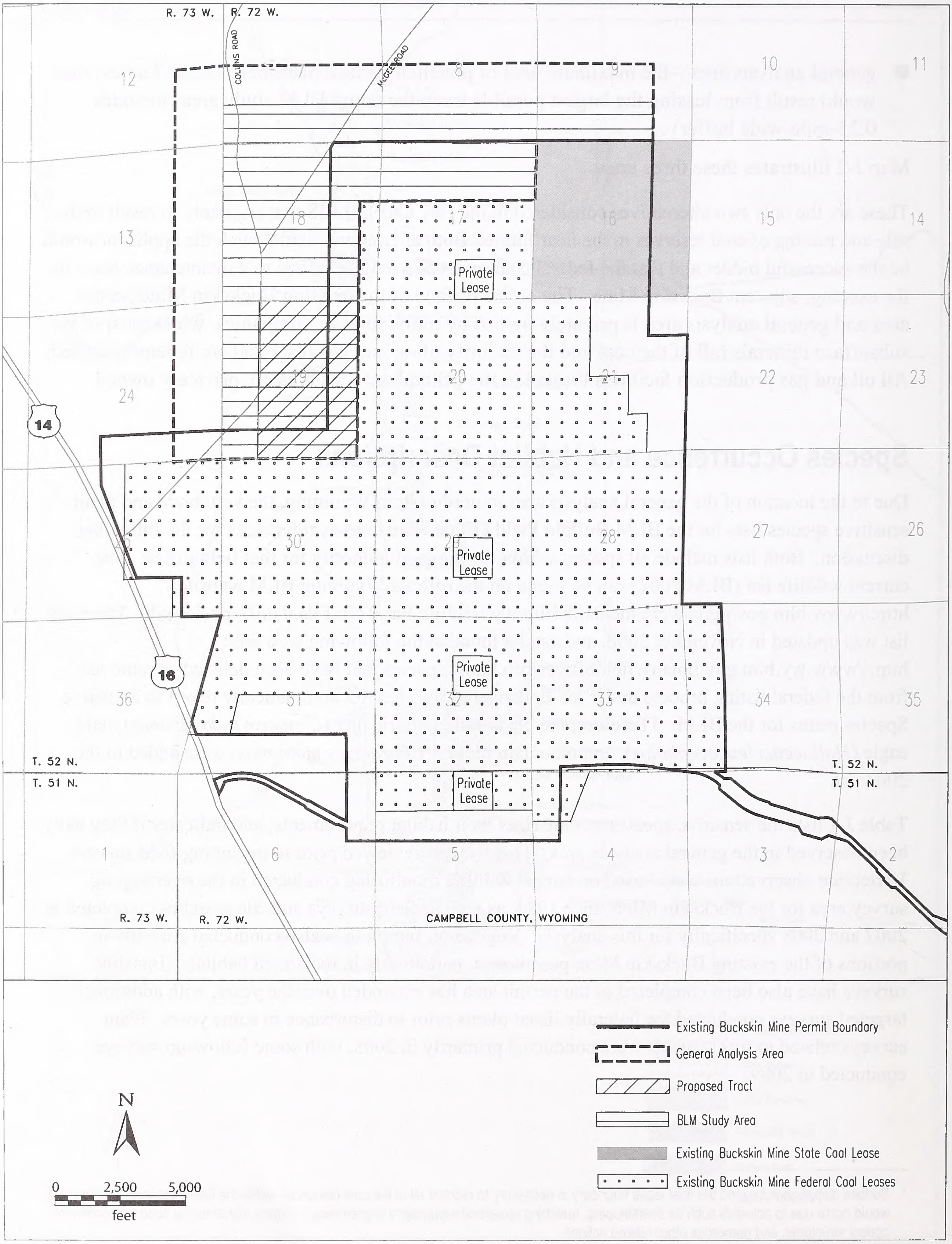
1 Surface disturbance beyond the final lease boundary is necessary to recover all of the coal resources within the final tract configuration, and would occur due to activities such as overstripping, matching reclaimed topography to premining contours, constructing flood and sediment control structures, and numerous other related actions



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Map J-2
General Analysis Area

Only two vertebrate sensitive species have been documented in the general analysis area in the last 25 years (1984 through 2008); the bald eagle and loggerhead shrike. No plant sensitive species have been recorded (Table J-1).

Although the bald eagle is a common winter resident in portions of northeast Wyoming, sightings within the Buckskin Mine survey area averaged only 0.5 eagles per year during that period. That annual monitoring area encompassed the entire proposed tract and much of the general analysis area each year. Potential bald eagle roosting and nesting habitat in the general analysis area is limited to three tree shelterbelts, with few additional trees in the surrounding area. One of the shelterbelts is in the portion of the general analysis area that overlaps with the existing permit area and is, therefore, subject to future disturbance regardless of the leasing action. The other two shelterbelts are adjacent to currently or recently occupied residences. No unique or concentrated prey sources (e.g., fisheries, sheep operations, large prairie dog colonies, concentrations of waterfowl) that would attract bald eagles are present in the area.

Loggerhead shrikes have occasionally been recorded in the general analysis area, including in the proposed tract. However, most shrike sightings occurred in grasslands and tree windbreaks in the west-central portion of the existing Buckskin Mine permit area. Adults and juveniles were periodically observed perched on fences and power lines in that area. Although no active nests have ever been found, the presence of young indicates that shrikes nest in the vicinity in some years.

The absence or extremely limited presence of specialized habitat types, such as forests and woodlands, caves, cliffs, large expanses of wetlands and lakes, and calcareous rock outcrops, among others, make it unlikely that species restricted to those habitats would occur in the general analysis area. Additional information on the occurrences of various species of interest in and near the general analysis area can be found in the data reports prepared in support of the Hay Creek II EIS and the annual reports prepared for the Buckskin Mine. These documents can be viewed at the BLM Wyoming High Plains District Office in Casper, Wyoming, and the Wyoming Department of Environmental Quality/Land Quality Division in Sheridan, Wyoming, respectively.

Table J-1. BLM Sensitive Species (Buffalo Field Office), Habitat Requirements, and Observations

Common Name (Scientific name)	Habitat[1]	Observed in the General Analysis Area
AMPHIBIANS		
Northern leopard frog *(Rana pipiens)*	Swampy cattail marshes, beaver ponds, and other permanent water in the plains, foothills, and montane zones up to 9,000 feet	No; no suitable habitat
Spotted frog (*Ranus pretiosa*)	Ponds, sloughs, small streams in foothills and montane zones	No; general analysis area is beyond species range; no suitable habitat
BIRDS		
Baird's sparrow (*Ammodramus bairdii*)	Shortgrass eastern Great Plains grasslands, weedy fields	No; general analysis area is beyond typical range for this species; no suitable habitat

Common Name (Scientific name)	Habitat[1]	Observed in the General Analysis Area
Bald eagle[2] (*Haliaeetus leucocephalus*)	Mixed coniferous forests, cottonwood-riparian near large lakes and rivers; forages in open habitats during the winter	Occasionally present in winter; limited winter roosting and nesting habitat; no reliable or concentrated sources of prey
Brewer's sparrow (*Spizella breweri*)	Basin-prairie and mountain-foothills shrublands, especially sagebrush, woodland-chaparral	Extremely infrequently; limited suitable sagebrush habitats
Burrowing owl (*Athene cunicularia*)	Grasslands, basin-prairie shrublands, agricultural areas, prairie dog colonies	No; limited potential nesting habitat
Ferruginous hawk (*Buteo regalis*)	Basin-prairie shrublands; eastern Great Plains, Great Basin foothills, and mountain-foothills grasslands; rock outcrops, isolated trees	No; limited potential nesting habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Basin-prairie shrub, mountain-foothill shrub meadows	No; limited suitable sagebrush and other year-round habitats
Loggerhead shrike (*Lanius ludovicianus*)	Basin-prairie shrub, mountain-foothill shrub	Infrequent non-breeder; limited habitat
Long-billed curlew (*Numenius americanus*)	Sagebrush-grasslands; eastern Great Plains, Great Basin foothills, mountain foothills, and wet-moist meadow grasslands; irrigated native meadows; with aquatic areas nearby, other agricultural areas and shorelines	No; limited wet or moist habitats for foraging; no suitable nesting habitat
Mountain plover[2] (*Charadrius montanus*)	Shortgrass and mixed grass prairies, Great Basin foothills grasslands, short sagebrush-grasslands, prairie dog colonies	No; no prairie dog colonies; grasslands typically too tall and/or dense
Northern goshawk (*Accipiter gentilis*)	Coniferous forests, especially Douglas fir and lodgepole pine, aspen; forages in a variety of habitats	No; no suitable habitat
Peregrine falcon (*Falco peregrinus*)	Cliffs, primarily along waterways	No; no suitable habitat
Sage sparrow (*Amphispiza billneata*)	Basin-prairie and mountain-foothills shrublands.	No; general analysis area is beyond typical species range in Wyoming; limited suitable sagebrush habitats
Sage thrasher (*Oreoscoptes montanus*)	Basin-prairie and mountain-foothills shrublands	No; limited suitable sagebrush habitats
Trumpeter swan (*Cygnus buccinator*)	Marshes, lakes, ponds, rivers	No; no suitable habitat
White-faced ibis (*Plegadis chihi*)	Marshes, wet-moist meadows, lakes, irrigated meadows	No; no suitable habitat
Yellow-billed cuckoo (*Coccyzus americanus*)	Open woodlands, streamside willow and alder groves; cottonwood-riparian below 7,000 feet, urban areas	No; no suitable habitat
FISH		
Yellowstone cutthroat trout (*Oncoryhynchus clarki*)	Yellowstone drainage, small mountain streams, large rivers	No; no suitable habitat

Common Name (Scientific name)	Habitat[1]	Observed in the General Analysis Area
MAMMALS		
Black-tailed prairie dog[2] *(Cynomys ludovicianus)*	Short-grass and mid-grass grasslands	No; no prairie dog colonies
Fringed myotis (*Myotis thysanodes*)	Conifer forests, woodland chaparral, basin-prairie shrublands, caves and underground mine shafts	No; limited suitable sagebrush habitats
Long-eared myotis *(Myotis evotis)*	Conifer and deciduous forests, basin-prairie and mountain foothills shrublands, riparian areas	No; no suitable habitat
Spotted bat (*Euderma maculatum*)	Known only from juniper shrublands and desert sagebrush-grasslands in Wyoming; cliffs over perennial water are important habitat component	No; no suitable habitat
Swift fox (*Vulpes velox*)	Eastern great plains grasslands, occasionally agricultural areas, irrigated native meadows, roadside/railroad banks	No, suitable habitat present
Townsend's big-eared bat *(Corynorhinus townsendii)*	Deciduous forests, dry coniferous forests; basin-prairie; mountain foothills and shrublands; desert grasslands; juniper	No; limited suitable habitat
PLANTS		
Northern Arnica (*Arnica lonchophylla*)	Open woods and slopes on sandy-gravel or limestone and shady, moist north-facing birch-hazelnut forests; elevation 6,500–8,000 feet	No; no limestone parent material or birch-hazelnut forest habitats; known populations in Wyoming are in Sheridan and Johnson counties
Porter's sagebrush *(Artemisia porteri)*	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes; 5,300–6,500 feet	No; no habitat due to soil type; known populations in Wyoming are in Fremont County
Soft aster (*Aster mollis*)	Sagebrush grasslands and mountain meadows on deep, calcareous soils at the edge of aspen or pine woodlands; elevation 6,400–8,500 feet	No; no habitat; known populations in Wyoming are in Niobrara, Natrona, Sublette, Washakie, Big Horn, and Sheridan counties
William's wafer parsnip *(Cymopterus williamsii)*	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides; 6,000–8,300 feet	No; habitat limitations include lower elevations and lack of limestone parent material; known populations in Wyoming are in Johnson, Washakie, and Natrona counties
Mountain lady's slipper (*Cypripedium montanum*)	Shady moist forests and riparian shrublands; elevation 5,400–5,500 feet	No; no habitat due to lack of shady forests and elevations; known populations in Wyoming are in Sheridan and Johnson counties
Rabbit buckwheat (*Eriogonum brevicaule var. canum [E. Lagopus]*)	Barren sandy or clay soils and rock outcrops in juniper woodlands and sagebrush steppe communities; elevation 3,800–5,500 feet	No; limited areas of habitat are present due to lack of juniper woodlands and rock outcrops; known populations in Wyoming are in Sheridan and Big Horn counties
Hall's fescue (*Festuca hallii*)	Meadows, slopes, and open woods; elevation 7,400–10,500 feet	No; no habitat present due to low elevations and lack of montane meadows and open woods; known populations in Wyoming are in Park and Johnson counties
Contracted Indian ricegrass (*Oryzopsis contracta [O. hymenoides var. c.]*)	Basin and foothill areas on dry, sandy soils; elevation 4,800–7,500 feet	No; habitat generally lacking or very limited; known populations in Wyoming are in Campbell, Washakie, Hot Springs, Natrona, Sweetwater, Carbon, and Albany counties

Common Name (Scientific name)	Habitat[1]	Observed in the General Analysis Area
Cary's beardtongue *(Penstemon caryi)*	Calcareous rock outcrops and rocky soil within sagebrush, juniper, Douglas-fir, and limber pine communities; elevation 5,200–8,500 feet	No; no habitat present due to low elevations and lack of soils and vegetation communities where this species is found; known populations in Wyoming are found in Big Horn, Washakie, and Sheridan counties
Northern blackberry (*Rubus arcticus ssp. acaulis [R. acaulis]*)	Boggy woods and marshes; elevation 7,000–9,000 feet	No; no habitat present due to low elevation and lack of vegetation communities where this species is found; known populations in Wyoming are found in Johnson County
Hapeman's sullivan (*Sullivantia hapemanii var. hapemanii*)	Moist calcareous outcrops and boulders in shady canyons and streams; elevation 4,600–8,200 feet	No; limited habitat due to lack of topography and moisture conditions where this species is found; known populations in Wyoming are found in Sheridan, Johnson, Natrona, Big Horn, and Washakie counties

1 Habitats for vertebrate terrestrial species primarily from Cerovski et al. 2004.

2 Former listed or candidate species under the Endangered Species Act automatically revert to BLM Sensitive Species upon delisting or removal from the federal listing process.

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